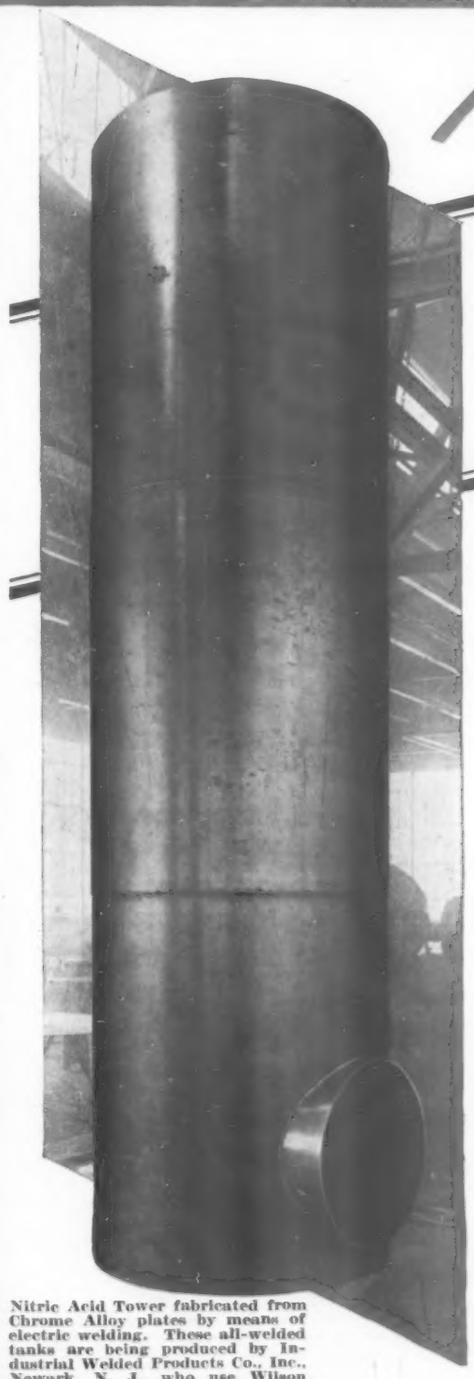
The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

NOVEMBER, 1928 VOL. 13, NO. 11

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. $4.00 per year abroad



Nitric Acid Tower fabricated from Chrome Alloy plates by means of electric welding. These all-welded tanks are being produced by Industrial Welded Products Co., Inc., Newark, N. J., who use Wilson Welding Machines exclusively.

NOW they're ELECTRIC WELDED!

NITRIC ACID TOWERS
made of Chrome Alloys
Are Being ELECTRIC WELDED
with *Wilson Machines*

HERE is one of the Nitric Acid Towers, made of non-corrosive chrome alloy, which Industrial Welded Products Co. Inc., Newark, N. J., is fabricating entirely by *electric* welding—and *exclusively* with Wilson Welding Machines! The welds in these tanks not only exhibit extraordinary strength and ductility, but also *resistance to corrosion equal to the chrome alloy plates which they join!*

In addition, Industrial Welded Products Co. is welding plates of chrome iron, chrome nickel alloys, special alloys and stainless steel in the construction of fans for heavy nitric fumes; large pressure acid tanks; pipes and fittings for nitric acid, and similar equipment.

These welds are uniformly sound and homogeneous. They can be ground flush and given a high polish. Their tensile strength equals at least 90% of the tensile strength of the plate itself, and they actually *exceed* the elastic limit of the plate. In ordinary use, they have resisted nitric acid of all concentrations, up to 185° F.

This work demonstrates the close current control that can be secured with the Wilson Machine—a current control so close and so stable, and of such value, that special alloy metals can be welded without losing the effect of their essential elements in the weld.

Send for illustrated Bulletins describing Wilson Model S Welding Machines.

WILSON WELDER & METALS CO., WILSON BUILDING., HOBOKEN, N. J.

WILSON

WELDING MACHINES AND WELDING WIRE

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

Look how we have improved this goggle

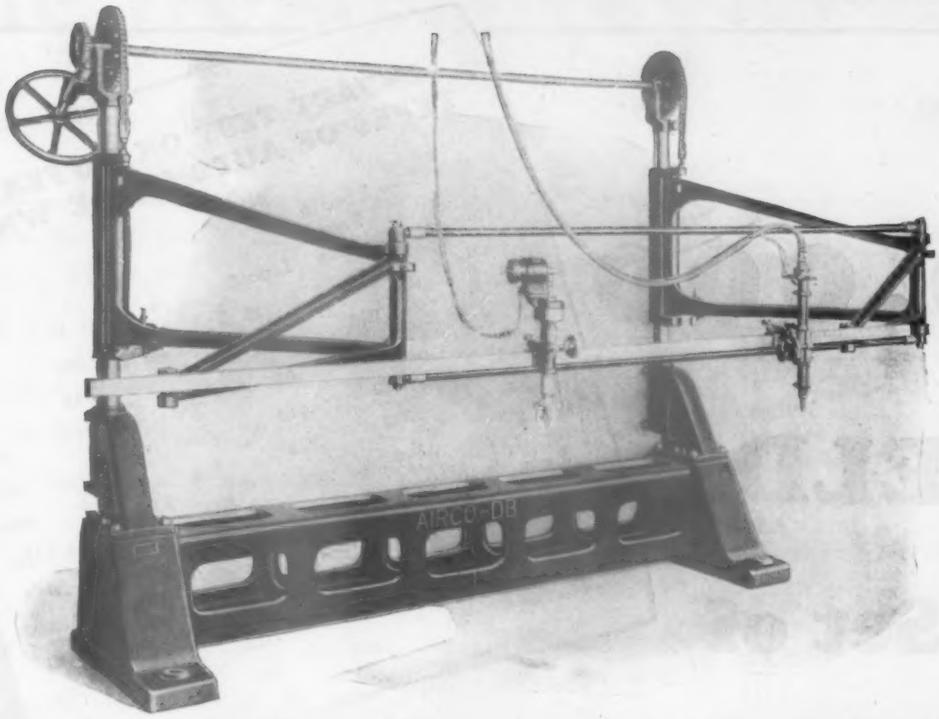
THE original Hardy Welding goggle *improved* — improved by protecting the ventilating slits with louvres which keep the sparks out. This is a real advance in welding goggle design. Perfect ventilation with perfect protection against sparks.

We have improved it still further by adding the new Noviweld lenses which give practically complete protection against infra-red and ultra-violet, and at the same time enable the wearer to see his work clearly. Prices (each) $2.50; (lots of 100) $2.15.

AMERICAN OPTICAL COMPANY

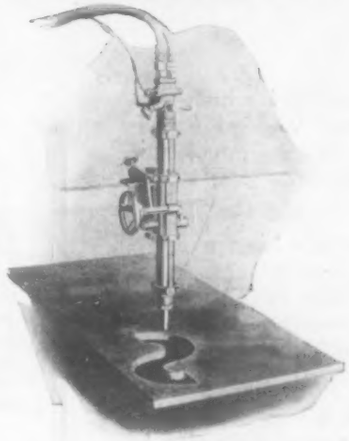
New York, St. Louis, San Francisco, Chicago, Kansas City, Atlanta

No. 4 OXYGRAPH



An Oxyacetylene Shape Cutting Machine

For cutting straight lines and irregular shapes in rolled steel sheets, plates, forgings or billets, with the oxyacetylene cutting torch. It attracted much attention at the National Metal Exposition and conventions of the American Society for Steel Treating and American Welding Society in Philadelphia, October 8-12. An Airco-Davis-Bournonville Machine.
(Patented)



The cutting torch automatically guided by motor-driven tracing device with 75-watt 110 volt Variable Speed Universal Motor for following drawing or templet. Actual cutting area with torch in one position, 52-in. circle, 41-in. square, 25x 84-in. rectangle. By shifting torch position these areas may be positioned within a maximum working area of 63x328 inches.

AIR REDUCTION SALES COMPANY

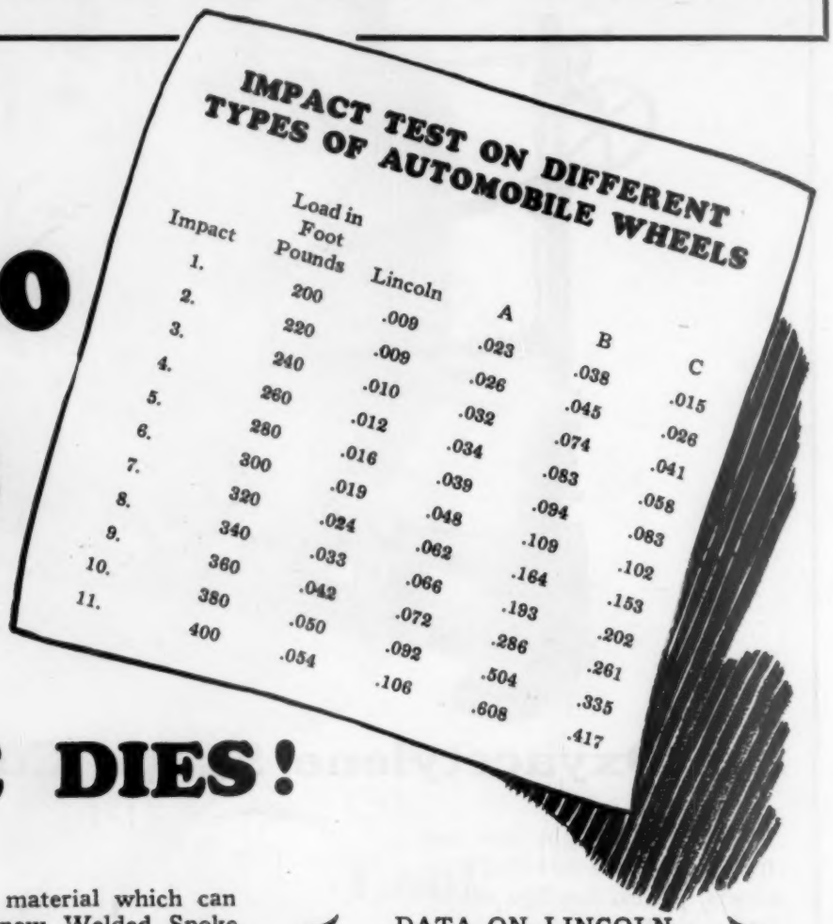
Manufacturers and distributors of Airco Oxygen, Airco Acetylene, Airco National Carbide Airco-Davis-Bournonville Welding and Cutting Apparatus and Welding Supplies

71 Plants *Home Office*—**342 Madison Avenue, New York City, N. Y.** **110 Warehouses**

District Sales Offices at Baltimore, Birmingham, Boston, Buffalo, Charlotte (N. C.), Chicago, Cleveland, Dayton, Detroit, Emeryville (Cal.), Jersey City, Los Angeles, Milwaukee, Minneapolis, New York City, Oklahoma City, Philadelphia, Pittsburgh, Richmond, St. Louis, Seattle, Wheeling (W. Va.)

80 ELKONITE* WELDS ON EVERY LINCOLN WHEEL!

10,000 WELDS Per Set of ELKONITE DIES!



ELKONITE is the only welding material which can be economically used on the new Welded Spoke Lincoln and Ford Wire Wheels. Hard Copper and various alloys fail at once but Elkonite Dies give 10,000 perfect welds!

Never in the history of welding has there been a more outstanding success. And Elkonite welds are strong! Compare the impact deflection on the Lincoln Welded Steel Spoke Wheel and A, B and C, representative wheels of other types including Artillery, Disk and threaded spoke and nipple type of wire wheel.

Deflection is measured in inches at equally spaced points on rim, but only reading at point of maximum deflection is given. Eleven blows were struck, the first being 200 foot pounds and the last 400 foot pounds.

See the table at the top for detailed data on the wheel as furnished by the manufacturer—conclusive proof of Elkonite superiority.

Let our engineers show you how Elkonite can be used effectively in your resistance welding—no obligation of course.

DATA ON LINCOLN WELDED SPOKE WHEEL

Spokes per wheel	40
Diameter of Spoke	$\frac{5}{32}$"
Rim	Drop Center
Hub Shell	One Piece
Number of Welds	80
Primary Volts	440 A.C.
Primary Amperes	400
Secondary Volts	6
Secondary Amperes	12,000
Actual Welding Time	1.2 Second

The wheel is welded in eight operations of ten spokes to each operation, there being 40 spokes and each spoke welded on both ends, making a total of 80 welds per wheel.

The rim, hub shell, and spokes are located in place by special designed fixtures for each operation so that after the last operation the wheel is round and true.

This type of wheel is over 20 per cent lighter than a wire wheel of the threaded spoke and nipple type.

ELKON, Inc.

Division of P. R. Mallory & Co., Inc., 350 Madison Ave., New York.

*Reg. U. S. Patent Office.

The Welding Engineer

Founded by L. B. Mackenzie, 1916

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Make the Holes First

FOOTBALL fans have been having a beautiful time this season, watching talented half-backs and full-backs make football history. But again and again the supporters of the losing team have groaned in dismay at the apparent slump suffered by a favorite backfield star. When the forwards in the line are not able to open holes in the direction of the goal, the runner has no place to run. The wise coach never rests on his oars when he discovers a wealth of backfield material in his squad. He must train the line to make opportunities, and he knows it. In business, this strategy is applied by using advertising to pave the way for the salesman. If he has to open up the holes as well as carry the ball, the coaching squad is counting too much on talent and not enough on strategy. Teamwork counts as much in business as it does in football and it takes a whole team to score touchdowns against smart competition.

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS
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Pressed Steel Tank Co.

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See "Cutting Electrodes"

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WHAT DO YOU LOOK FOR IN A BRONZE WELDING ROD?

Good Welding Rod, you say, should melt and flow freely. It should solidify free from blow-holes and porosity; should unite readily with the base metals to be welded; should possess great strength; should machine easily and, if desired, should take a high finish.

Chase Chāmet Bronze Welding Rod fulfills these requirements admirably. It is made from our own particular mixture of bronze, specially named "Chāmet" to distinguish it from other bronzes. Each piece is stamped with the unmistakable Chase-mark shown at the bottom of the page.

And furthermore . . . When it's a matter of quick delivery you can depend on Chase service. Thirteen Chase warehouses throughout the country mean that there's a Chase warehouse near you. Order from any one of them or through them from the factories and mills of the Chase Companies, Inc., Waterbury, Connecticut.

Look for the new Chase-mark on box, label, and tag; and for the Chase-mark shown below which is stamped on each end of Chase Chāmet Bronze Welding Rod.

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CHASE BRASS AND COPPER CO.
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Handy & Harman
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Bissett Steel Co.
SPOT WELDERS
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Metal & Thermit Corp.
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International Oxygen Co.
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Stoody Company
Torchweld Equipment Co.
Victor Oxy-Acetylene Equipment Co.
Weldit Acetylene Co.
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TRUCKS (Cylinder)
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Imperial Brass Mfg. Co.
International Oxygen Co.
Torchweld Equipment Co.
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Air Reduction Sales Co.
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Air Reduction Sales Co.
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Modern Engineering Co.
National Carbon Co.
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C. Sorensen
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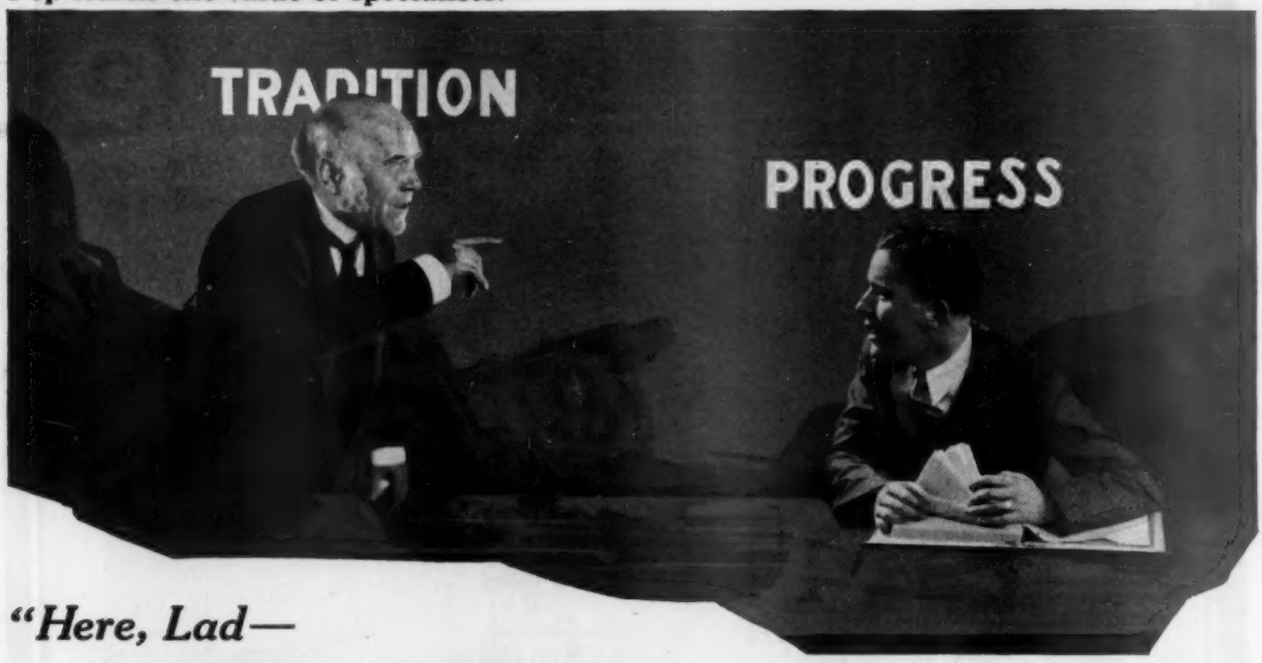
Pop learns the value of specialists.



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If Lincoln made a thousand other electrical items they would still have specialists in the welding department."

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"Yes, Pop—

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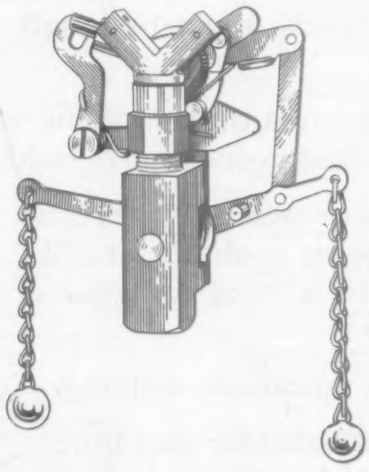

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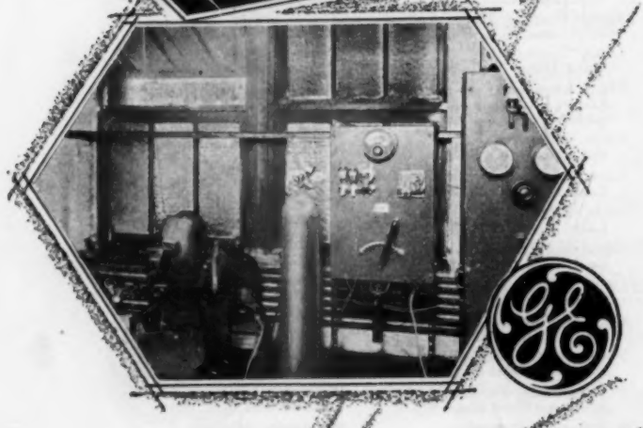

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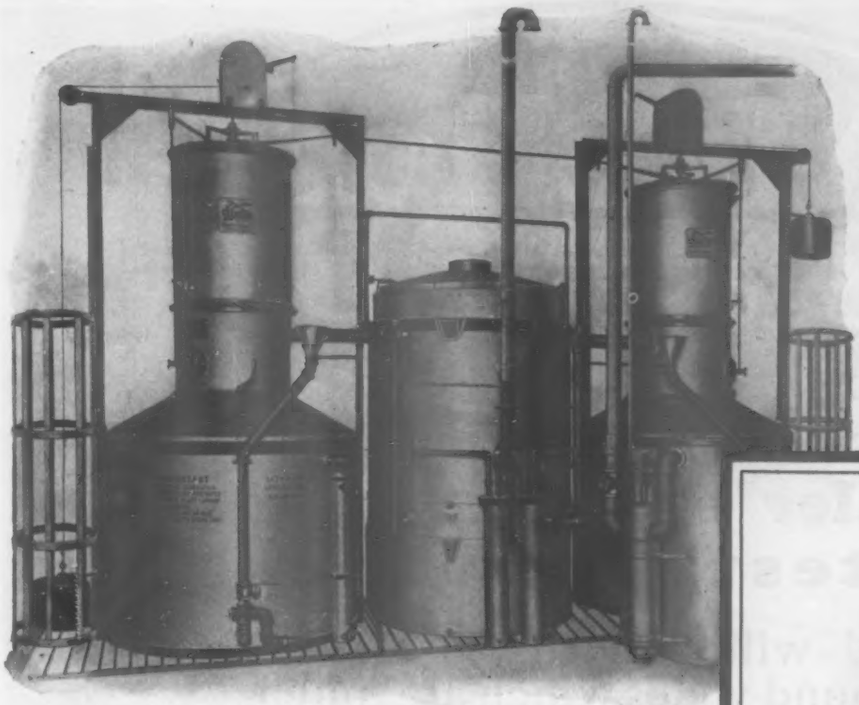

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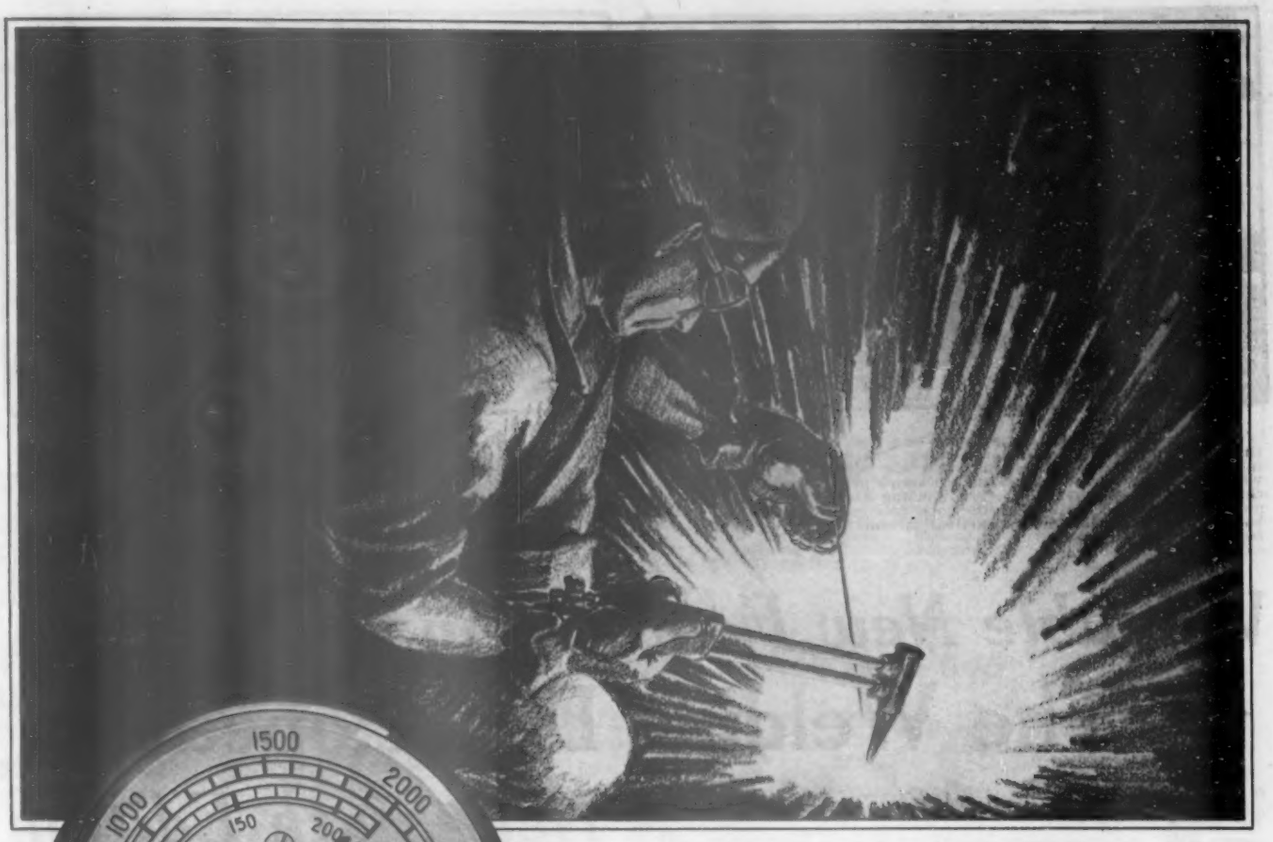

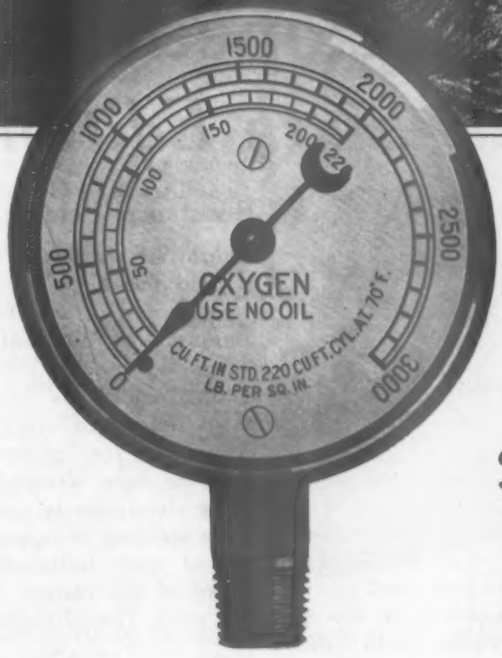

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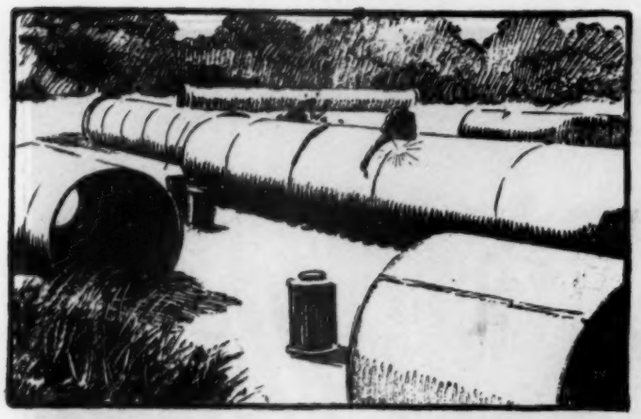
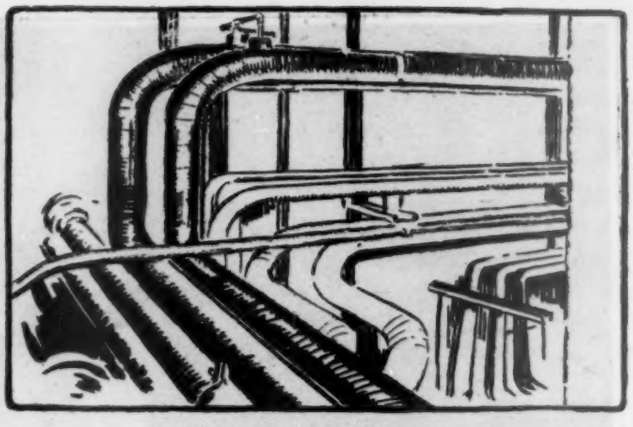


Operators, supervisors, and engineers on a pipe line job, who are continually facing new problems of welding procedure, need a source of information that can go right into the field with them, always ready with the answer as quickly as the questions arise. In no place more than in the oil and gas fields is The Welding Encyclopedia appreciated and relied upon by the men on the job. One reason is that it is not a book of theory alone, but of practical information which is obtained from actual experience.



The growing popularity of welding in the installing of industrial pipe systems for steam, water, oil, or gases, obligates both the piping contractor and the plant engineer to become thoroughly acquainted with the best welding practice in this class of work. The welded line insures the utmost in operating efficiency, providing the welding is properly done. As a reference volume for pipe welding facts and data, the Welding Encyclopedia is complete, reliable, and up-to-date.

Valuable New Features in
The Welding Encyclopedia
New Sixth Edition

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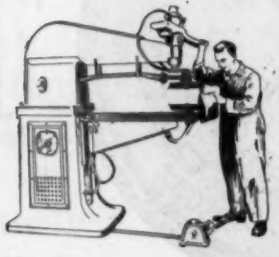
Recent improvements in both manually operated and automatic arc welding equipment, new electrode materials, and the development of new processes, all challenge your knowledge of what is the latest and best in arc welding procedure for your particular job. The latest and best is always to be found in the Welding Encyclopedia, which also contains design data for welding of building structures or of machine bases and frames.

Oxy-Acetylene Welding

Within the last two years there have been many developments in the application of this process. The growing use of stainless steels, for example, has called for a special technique which has successfully welded metals formerly not considered weldable. Bronze welding, hard-facing of cutting edges and grinding surfaces, have also seen important improvements and new applications. All of these developments are fully covered in the Sixth Edition.

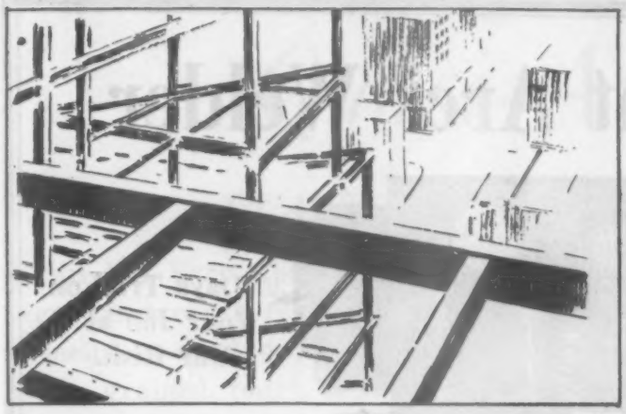


Resistance Welding

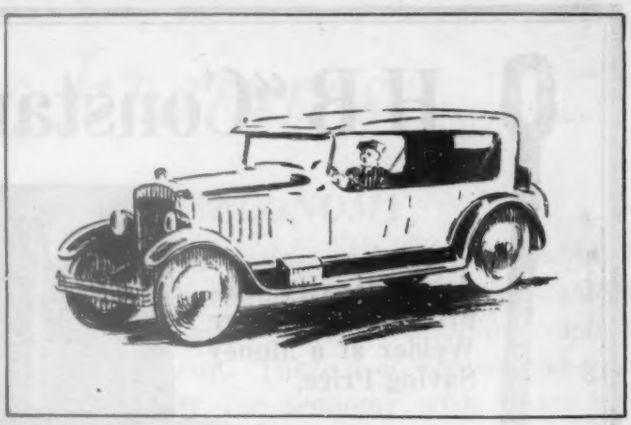
Important progress in this field has been made in the design of a great number of automatic welders for specific jobs, effecting enormous savings of time. Of importance, also, to present users of resistance welding are the new electrode metals and the methods of facing electrodes to prolong their life and to facilitate the welding of certain metals. For the fundamentals of spot, butt, and seam welding, and for the design of the variety of joints possible by this process, read The Welding Encyclopedia, Sixth Edition.

Thermit Welding

Since repair work that calls for Thermit welding is usually a large job, recent improvements in the process which have effected a considerable saving in both time and material in the making of the molds and in the welding, are of great importance to steel mills, ship yards, and other users of heavy machinery. The chapter on Thermit welding was prepared expressly for The Welding Encyclopedia, Sixth Edition.



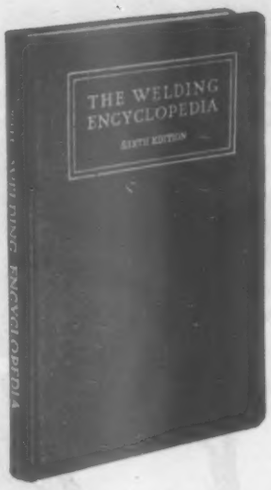
Numerous all-welded residences, factories and bridges have proved the practicality of structural welding, but few architects or engineers are yet equipped with all of the information necessary to insure both safe and economical welded construction. Do you know, for example, the amount of weld metal required to replace a rivet of a certain size? Or the design of a joint which gives to the fullest extent all of the advantages offered by welding? These and scores of other fundamental questions The Welding Encyclopedia will answer for you.



There are always opportunities to reduce costs and to improve the product if those in charge of welding are thoroughly acquainted with the latest refinements of the processes. The automobile industry has achieved remarkable economies by following this principle, and is one of the many sources of the wealth of new welding information brought together in this one volume. Thousands of copies of the Encyclopedia are now in use by production engineers who want to be informed on the most efficient welding procedure.

The Welding Encyclopedia is the only book that covers completely all branches of the art of welding.

The editorial office of The Welding Engineer is recognized as the headquarters for authoritative information and help on all branches of welding, and conducts a large volume of correspondence helping welders and welding departments out of their difficulties. In a period of eight months it was found that 95% of the problems submitted to this office were answered directly from the pages of The Welding Encyclopedia.



It tells how to weld every weldable metal by each of the welding processes. ¶ It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. ¶ It tells how to prepare parts for welding. ¶ It tells how to install and care for welding equipment. ¶ It explains the meaning of all words and terms found in welding literature. ¶ It tells where to buy all standard makes of welding apparatus and supplies.

496 Pages—645 Illustrations

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The table of contents below can give you only a very general idea of the scope of this work. Send for the book and give it a careful examination. We guarantee that it will be fully satisfactory and if not we will cheerfully make a refund.

Contents

1. Illustrated encyclopedia covering all words, terms and trade names used in welding.
2. Oxy-Acetylene Welding.—Aluminum, Steel, Cast Iron, Brass Bronze. (Full instructions for welding each of these metals.)
3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
4. Electric Resistance Welding.—Includes Butt Welding, Line Welding, Percussion Welding and Spot Welding.
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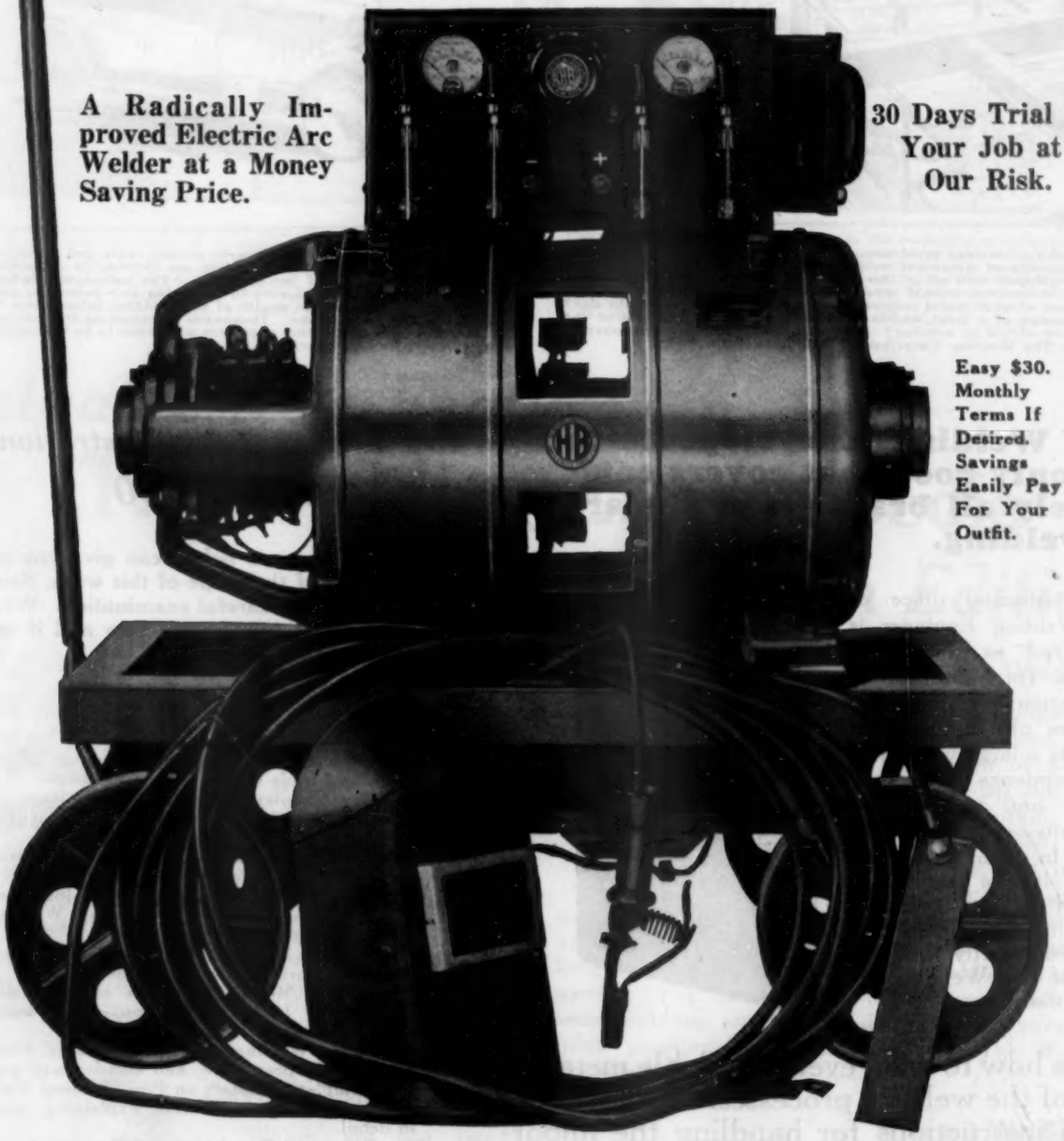

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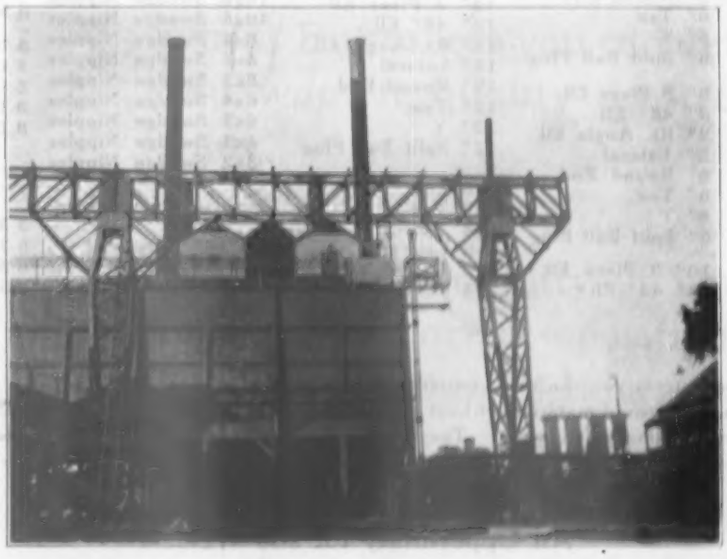
Showing in foreground welded gantry girder carrying one end of traveling bridge conveyor for coke.

Welded coke bunkers 97'x67'x27' have a capacity of 2,200 tons.



Above bunkers is welded framing for coke conveyors under construction.

In rear of bunkers are two 5' diameter, 120' height welded chimneys, surmounting a welded retort house.

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3" Rt. Angle Ell
3" Lateral
3" Round End
3" Tee
3" Y
3" Split Bull Plug
4" 3 Piece Ell
4" 45° Ell
4" Rt. Angle Ell
4" Lateral
4" Round End
4" Tee
4" Y
4" Split Bull Plug
6" 3 Piece Ell
6" 45° Ell
6" Rt. Angle Ell
6" Lateral
6" Round End
6" Tee
6" Y
6" Split Bull Plug
8" 3 Piece Ell
8" 45° Ell
8" Rt. Angle Ell
8" Lateral
8" Round End
8" Tee
8" Y
8" Split Bull Plug
10" 3 Piece Ell
10" 45° Ell
10" Rt. Angle Ell
10" Lateral
10" Round End
10" Tee
10" Y
10" Split Bull Plug
12" 3 Piece Ell
12" 45° Ell
12" Rt. Angle Ell
12" Lateral
12" Round End
12" Tee
12" Y
12" Split Bull Plug
4x3 Tee
6x3 Tee
6x4 Tee
8x6 Lateral
8x3 Tee
8x4 Tee
12x3 Swedge Nipples
12x4 Swedge Nipples
12x6 Swedge Nipples
12x8 Swedge Nipples
12x10 Swedge Nipples
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5 3/16" Round End
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6 5/8" 3 Piece Ell
6 5/8" 45° Ell
6 5/8" Lateral
6 5/8" Round End
6 5/8" Tee
8 1/4" 3 Piece Ell
8 1/4" 45° Ell
8 1/4" Lateral
8 1/4" Round End
8 1/4" Tee

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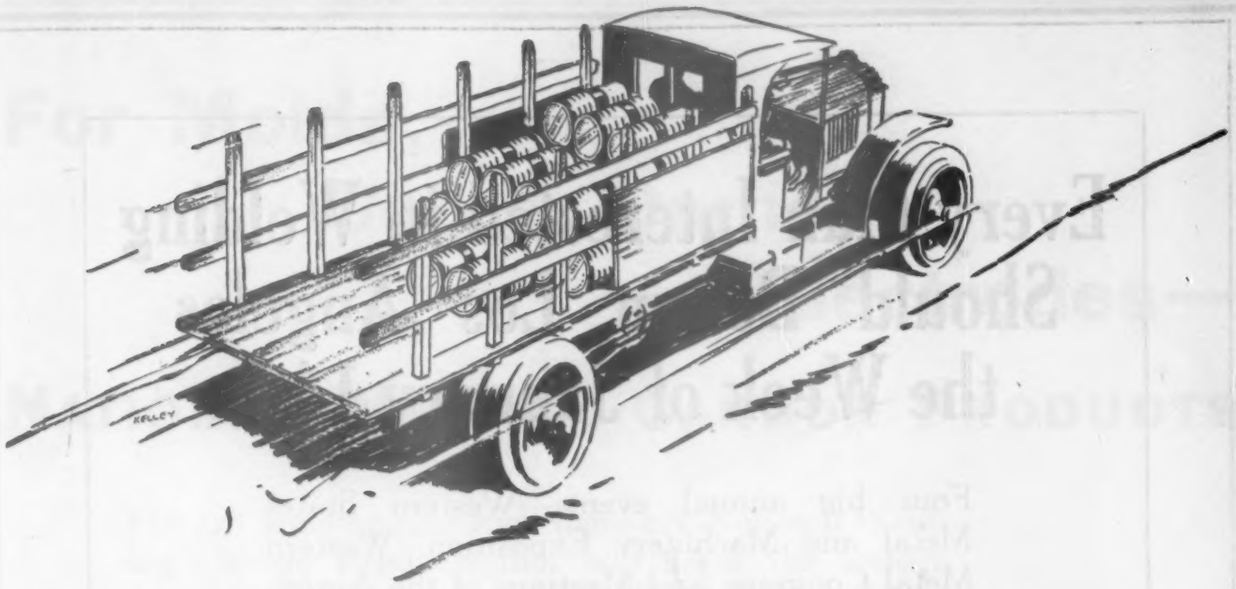

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Every Man Interested in Welding Should Be in Los Angeles the Week of January 14th

Four big annual events—Western States Metal and Machinery Exposition, Western Metal Congress, and Meetings of the American Society for Steel Treating and of the American Welding Society all in this one week will provide a perfect opportunity to study welding in every phase of its applications. With technical discussions at the Welding Society sessions, and with exhibits of welding apparatus and actual demonstrations of all of the welding processes, there will be something of interest to every man interested in welding from any angle. You have never had such an opportunity to combine a study of the latest welding developments with a vacation trip to the Land of Sunshine.

There are a few exhibitor's spaces left. If you wish to exhibit, please rush your reservation.

Shrine Auditorium Los Angeles

Special Train—Special Rates—With Stopovers

For those coming from the East, special round trip rates have been arranged, with the return trip optional via several routes, including a stop-over at Grand Canyon. For information regarding transportation, or reservation of exhibitor's space, write

W. H. Eisenman,

Director, Western States Metal & Machinery Exposition

665 W. Jefferson St., Los Angeles, Calif.

January 14th to 18th 1929

For Molds, Cores, Dams, Electrodes—

NATIONAL WELDING CARBON PRODUCTS

FOR any welding operation there are National Welding Carbon Products that will assist the welder greatly in doing the best kind of job, more quickly. For gas welding, carbon blocks, rods, paste and flour are particularly valuable for the building of molds, cores, dams, and the shielding of adjacent parts from the intense heat of the flame.

For electric welding the same products find similar uses, and in addition there are National Welding Carbon Electrodes. These are in increasing demand as the special advantages of the carbon arc meet more and more welding conditions.

We are ready at all times to assist you in perfecting your welding technique through the use of National Welding Carbon Products.

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Strong Welds are made only when the best electrodes are used. Roebling Welding Wire is manufactured to meet the most rigid specifications. It is uniform in quality throughout each shipment and throughout all shipments. Look for the ® trade mark stamped on each electrode.

Catalog A-529

John A. Roebling's Sons Company, Trenton, N.J.

EDITORIAL

American Production and Foreign Markets

SOME very interesting and startling facts have come to hand on the machinery industry and are listed in a recent circular from the Bureau of Foreign and Domestic Commerce. For instance, a German professor figured out for the German machine industry that the United States produced 57 percent of the world's machinery against Great Britain's 13 percent and Germany's 13 percent. On the other hand it was also figured out that we only exported 10.1 percent of our total machinery production in 1925 against Great Britain's 29.8 percent and Germany's 25.3 percent. It has been proved that although we pay wages which are three times as high as those abroad our workers produce more than three times as much work per capita as the workers of other countries. Also since 1913 we have increased this 40 percent while in Germany there has been a falling off of 40 percent and in the United Kingdom a falling off of 20 percent. All this is found in the April, 1928, number of "Mechanical Engineering," being based upon data compiled by the German Machinery Industry for the League of Nations, Economic Conference in Geneva.

Another very interesting fact showing the strides that America has made in its export business is brought out in a reprint of Commerce Reports, July 2, 1928, on the principal markets for American industrial machinery. In 1910 we exported only $49,117,000 while in 1927 the total amounted to $183,169,000. From all indications 1928 will show even greater progress.

A further point of interest in this article is the change in principal markets. In 1910 Europe and Canada were our two largest markets while today Latin America comes first with Canada a close second. A third document of interest in this connection is a paper on developing machinery markets abroad, prepared in pamphlet form by the Department of Commerce. This takes up the more important problems of the exporter including representation abroad, shipping and packing, co-operation with representatives, advertising, preparedness to handle export business at home and other problems which constantly come to the attention of the exporter. All this material has been gathered together by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce through the courtesy of the Industrial Advertisers' Association.

Why Underwater Cutting Takes Time

OLD timers in the handling of the oxy-acetylene cutting torch may wonder at the time data given in stories which have been published regarding under-water cutting operations. It does seem to take a long time compared to the time required for cutting on land and under favorable conditions. But there has been published in a recent issue of The Saturday Evening Post a story signed by the familiar name of Commander Edward Ellsberg, which tells of the raising of the S-51. It is full enough of thrills to satisfy the most ardent lover of adventure stories. Reading it, one wonders how a cutting torch could be used at all under such trying circumstances. But here appears a picture of the heroic John Kelley, whose feats under water have been described in the trade papers of this industry several times and the torch cutting enthusiast proceeds to absorb the details of hardship which have for lack of space been omitted from the stories of the cutting operations themselves.

Welding in "Anti-Bunk" Territory

RECALLING the "anti-Bunk" presidential campaign of the irrepressible Will Rogers, one is reminded that in January a great metal congress will be held not far from the home of the famous comedian. It is said that that region has as much to boast about in its welding as it has in its climate, but the welding fraternity out there is strongly anti-Bunk. They've been too busy welding to do much boasting. At the same time they are willing enough to show their stuff, and in January their contribution to the progress of welding will be worth going many miles to see. The Pacific Coast region is increasing its metal working activities to a remarkable degree, all the way from Canada to Mexico, and folks out there are not overlooking any chances to make welding work in their favor. Furthermore they are not waiting to be told how, finding it quicker to learn how themselves. The welding industry will look forward with interest to the great gathering of pioneering talent which is being arranged, and reports so far received indicate that the event will be up to expectations in every respect.

Boosting the Process Is Good for Your Job

WHAT conception of the welding process does the average citizen have? To obtain an example of this just bring up the subject in an indirect way while talking with some one in another line of business. A salesman of a well known tool company responded to such a suggestion as follows: "Welding? Sure that's a good thing for mechanics to know. The other day I tore my bumper loose getting out of a parking place. I took the car to a garage and a welder there fixed the bumper in less than a half hour. It sure is a fine means of making those kind of repairs."

This is a fair example of the knowledge generally held of the possibilities of welding. To most people it is a somewhat mysterious means of making repairs on broken metal parts. It very seldom extends much further, and for that reason the good will of public opinion toward this field is very much underdeveloped.

A good positive public opinion toward a newly developing process is a great aid to it. The rapid development of the radio and the airplane are outstanding examples of this. They of course contained attractive features which caught the fancy of the public. The welding process contains very few features which appeal to the general public, but it does contain features which should appeal to the industrial public. To reach a desirable position in the opinion of the industrial public will require a thorough diffusion of knowledge on welding throughout the country. In order to obtain this it will be necessary for all those connected with any phase of the welding industry to aid in the gradual diffusion knowledge on this subject. Their part in such a program would consist of continually suggesting further uses of welding to the people they are serving.

This procedure is actually being carried on by a number of the more far-sighted welding supply manufacturers, and with good results as far as it goes. But to be thoroughly effective it should be put into practice by not only the numerous supply men, but by the even greater number of users of these supplies and appliances. It is up to the welders to realize what the supply men already know: that is, the greater the knowledge and the confidence of the public in the welding process, the greater will be the volume of the welding business.

The Ace of Welding Torches

Designed especially for the Manufacturer of airplanes. It will handle all the work encountered in modern airplane construction.

REGO
Model SM

Several large airplane Manufacturers requested us to design a torch especially to meet the needs of airplane work. By combining the design-experience of Rego engineers with the operating experience of air-plane welders, we have developed a torch which has met with unqualified approval in the airplane shops.

The Bastian-Blessing Company

240 East Ontario Street, Chicago, Illinois

Choice of Cast Iron Welding Methods

Size and Shape of Parts, Preheating Facilities, Importance of Avoiding Warping and Other Factors Influence Choice of Procedure and Materials

By P. L. Roberts

(Editor's Note: In the October issue the article by F. E. Totten explained the principles of proper preheating to make a satisfactory cast iron weld. In this article the application of these principles is illustrated by two types of cast iron welding jobs.)

THE large guillotine frame was cracked in three places as shown in Figure 1. The machine was being used day and night on production when the breakage took place due to overloading the machine. It was essential to get the machine back into commission at the earliest possible moment, so the fractured end was unbolted from the remainder of the machine and taken away for welding.

The frame was carefully packed up from the floor on fire bricks, each part being carefully located in its correct position. Crack No. 1 was melted out with a large oxy-acetylene blow pipe, and then the crack was welded. Only a little local preheating with the blow pipe was done prior to welding. Without waiting for this weld to cool, crack No. 2 was melted out and immediately welded. The whole casting was then turned over in order to weld the opposite sides of the two cracks.

At this point the cylinder of oxygen which was being used became exhausted and had to be replaced with a new one. Due to the delay so caused the welds had time to cool off and weld No. 2 broke due to uneven contraction. This points to the moral of having everything completely prepared before commencing to weld.

Weld No. 1 was brought to bright red with a blow pipe and then the recracked portion was again welded and immediately it was complete the casting was turned over rapidly and the other side of both cracks fused with a light run of weld metal. The whole was then allowed to cool slowly, by covering with fire bricks.

Prior to welding crack No. 3 the casting was completely surrounded by fire bricks in order to conserve heat and ward off any draughts. Two coal-gas blow pipes were inserted through two gaps in the fire bricks and the flames directed as shown by the arrows "A" and "B", in the figure. The top of the casting was covered with a large piece of sheet iron.

When the whole of the center portion of the casting was red hot the metal on either side of the crack was melted away to form a "V". Welding was commenced from the point "O", the coal-gas blow pipe flames being kept on the casting during the whole process. The casting was then rapidly turned over and the opposite side of the crack welded. To complete the welding it was necessary to stand the frame upright and weld the portion "EF". During this operation the casting was protected from draughts by sheets of iron. The flame was laid down and the whole of the welded portion of crack No. 3 was brought to bright red temperature and then allowed to cool slowly. In order to obtain uniform cooling it was necessary to direct one of the blow pipes in the direction of the arrow "B" to keep the temperature of this thinner portion equal to that of the larger mass "M". From time to time the flame was reduced in size, and finally the compressed air was turned off, leaving a flame of less intensity. This cooling operation had to be carried out very carefully in order to maintain a uniform temperature throughout the welded portion of the casting. When the temperature of the casting had fallen to 300° C. the preheating blow pipes were entirely removed, and the casting allowed to cool all night in the "oven" of fire bricks.

Ten lbs. of silicated cast iron welding rods were used and a flux of the following composition:

Borax	75%
Sodium Bicarbonate	15%
Iron Carbonate	10%

The time taken to weld the casting was approximately six hours. The total approximate cost was $22.

Examination of the casting when cold showed that the welds were perfectly satisfactory and that there was no evidence of any fresh cracks starting due to uneven contraction.

The frame was replaced and the gullotine has now been in use for some considerable time and is giving complete satisfaction.

The press frame shown in Figure 2 was used for punching

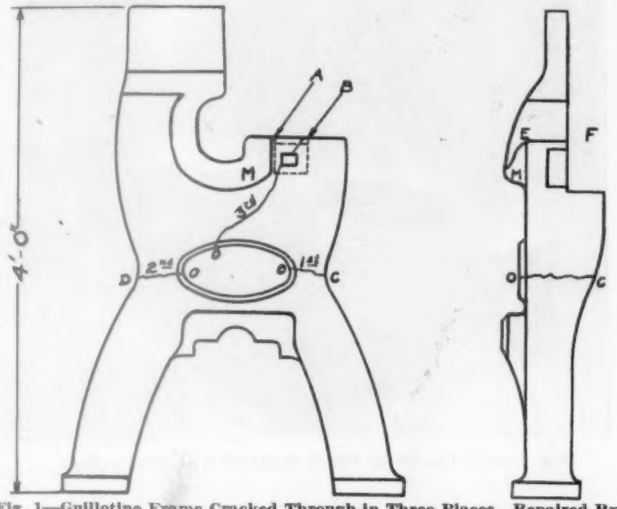

Fig. 1—Guillotine Frame Cracked Through in Three Places. Repaired By Oxy-Acetylene Welding, Using Cast Iron Rod.

armature cores and was being used continuously on this important production work. A crack developed in the side of the frame and rapidly became worse under the working conditions of shock and vibration. Finally the crack spread completely across the frame. The punch shop concerned was not particularly alive to the possibilities of welding and an attempt was made to repair the crack by bolting on a steel plate. The plate was 10 in. long by 6 in. wide by ⅞ in. thick, and was bolted on the inside of the frame. The four ⅝-in. bolts holding it across the crack can be seen in the figure. This attempt to repair the frame was entirely unsatisfactory as considerable movement took place between the punching head and the base which held the die. The machine was then dismantled and the frame sent to the welding shop.

The frame was laid on the floor with the crack horizontal and coal gas pre-heating blow pipes were directed across the fractured portion. When the portion about the crack had reached a temperature of 500° C. the latter was completely veed by melting out from the outside. Welding was commenced with a No. 7 Ox-Hy Carbon blow pipe, using a ⅜ in. silicated cast iron filling rod and borax as a flux. The welding of the crack was a long, laborious and very hot job, on account of the thickness of the frame, the thinnest portion of this being 2 in. in cross section, and the thickest portion 4 in. The

press frame on either side of the weld was kept red hot for a distance of 3 or 4 ins., and this region was allowed to cool very slowly when the welding was completed. Precautions were taken to insure uniform cooling of the whole section, the coal gas blow pipe being directed on the thinner portion to compensate for the greater rate at which it lost heat. Despite these precautions it was found on examination when the casting was cold that the weld had fractured almost completely across.

From this experience it appeared that the only satisfactory method of welding the casting would be to preheat entirely. There were two important objections to doing this, the first being, the possibility of distorting the machined bearing surfaces (for the punch head) relatively to the die base. The

Fig. 2—Cast Iron Press Frame Repaired With Bronze Rod.

second objection was the difficulty of standing near enough to such a large mass of red hot metal to weld satisfactorily. It was decided, therefore, to braze the casting.

The region about the crack was again preheated with the coal gas blow pipe, and the crack again veed out by melting the weld metal out. The same blow pipe as before was used for this purpose and for the subsequent brazing. A brazing material known as Siftbronze, of approximately the following compositions, was used;

Copper	60%
Zinc	35%
Tin	5%

This corresponds very closely to the material known as Tobin Bronze. Anhydrous borax was used as a flux.

The method of procedure was to raise the sides of the vee to a bright red temperature applying a small quantity of borax during the operation, and then coating the sides with the Siftbronze, by rubbing the rod in contact with the metal. When the sides of the vee were thoroughly coated with a thin layer, the brazing material was run into the vee as fast as it could be melted with the flame. Care was taken to puddle the metal in order to insure proper alloying with the coated sides of the vee. The operation was continued until the deposited metal was slightly higher than the surfaces of the casting and then the whole was completely covered and allowed to cool slowly.

When cold the brazed portion was carefully examined for cracks, but was found to be entirely free from any signs of these. All the contraction stresses were taken up by the ductile bronze, which stretched on contracting during cooling without seriously affecting its mechanical properties. The press has now been put back into service and is expected to give satisfaction.

BRITISH COMMENCE CONSTRUCTION OF WELDED STEEL AIRCRAFT

By A. C. Blackall

It has just been announced by A. V. Roe & Co., the well-known British constructors of aircraft, that they have entered into arrangements with the Fokker Aircraft Company of Holland for the manufacture in the United Kingdom, Irish Free State, India, Austrialia, New Zealand, South Africa, and other British possessions of triple-engined Avro monoplanes similar in design and construction to the Fokker F7 monoplane now in use for the Dutch East Indies air mail service.

This is a monoplane with a thick wooden wing covered with three-ply, a welded steel fuselage, and three Armstrong Siddeley Lynx engines of 200 horse-power each, and it is a distinct triumph for Anthony Fokker that in effect his method of design and construction should now be used under license by a British firm. So far British official policy in construction has been rather lukewarm in the use of welded joints in air-craft construction owing to the problems of inspection for strength, but the record of Fokker's products has long since shown that no difficulties arise in practice, and it is hoped that in due course welded steel tube construction will be as much used in British monoplanes as in American. It has been known for some time that A. V. Roe & Co. have been experimenting at Hamble with welded steel fuselages, and presumably, having satisfied themselves of the advantages, they have now secured the right to use Fokker's researches to develop further this construction.

No mention is made of rights of sale in Canada, and presumably Mr. Fokker has reserved for the American Fokker Co. this big adjacent market. The Avro Company has evidently satisfied itself that for commercial aircraft at any rate there will be no difficulty in securing a full certificate of airworthiness, and this definite espousal of welded steel construction by a British firm may well have an influence on new commercial types, for it has the merit of lending itself to economical construction. The Avro Company is now giving prices and dates for delivery of the Avro welded steel monoplane, indicating that it is now ready for immediate production.

ATLANTIC CITY TO HAVE WELDED POWER HOUSE

Steel work is in progress on the erection of a new power house addition at Atlantic City, New Jersey, but the neighbors are undisturbed by this work because welding is being used instead of riveting in the construction. On account of the size of the building engineers and steel contractors in our part of the country are watching the progress of this building with considerable interest. The addition now under way is an eight story building, 134 feet in height, 80 feet wide and 74 feet deep, the steel frame work of which is to be entirely welded together. A General Electric 400 ampere arc welder is being used for the job. The welding is being done by workmen of the Bethlehem Steel Company. Katcham and McQuade of Philadelphia are the general contractors for the job which will cost a total of about $250,000. When completed the power house will cover a plat 74 ft. x 142 ft. which is said to be the largest privately owned power plant in the East.

Education Stressed in Convention

International Acetylene Association Publishes Report Showing Widespread Use of Oxy-Acetylene Processes in Metal Industries

THREE busy days, November 14-15-16, the International Acetylene Association staged at the Congress Hotel in Chicago, a convention which brought to light a great fund of new and interesting information regarding the many uses for oxy-acetylene welding and cutting in the various industries of this country. The Association was complimented for its forward-looking policies by Mr. Homer Buckley, a director of the Chicago Association of Commerce who made the address of welcome on November 14. At the close of that morning session Professor J. D. Hoffman of Purdue University delivered the keynote address of the Convention, indicating specifically the importance of educational work in making it possible for all industries to take advantage of new processes as fast as they are developed and pointing out what is already being done to familiarize the future engineers of the country with possibilities of welding.

Prof. J. D. Hoffman, Purdue University.

Prof. C. F. Keel, Managing Director, Société Suisse de L'Acétylene

Homer J. Buckley, Chairman of the Advertising Council of the Chicago Association of Commerce.

In line with the obvious importance of educational work is the work of the Oxy-Acetylene Committee of the Association, during the past year. This Committee has gone to a great many reliable sources of information to secure the material which stands as the most comprehensive survey of the possibilities of oxy-acetylene welding and cutting that has ever been attempted. The material gathered from these sources mounted to such a large volume that it was not considered practical to present it in detail before the meeting. Consequently, the different portions of it were condensed. Even in condensed form the complete report amounted to over 40,000 words. It was desired to have some discussion of this report at the meeting so it was printed in advance of the Convention and distributed at the meeting and discussion invited upon different topics without reading the report itself.

As a piece of literature for the oxy-acetylene welding and cutting industry, the compilation of this report is a notable accomplishment. Altogether it discusses some 40 topics relating to the oxy-acetylene processes and their applications. Following are reproductions of a few of the portions of the report relating to applications of the oxy-acetylene processes which are attracting considerable attention at this time because of the developments which have been made in these applications within the past two or three years:

"Commercial Refrigeration": "American manufacturers of refrigeration apparatus were among the first to recognize the value of modern welding processes applied to the fabrication and assembly of refrigeration components.

"The necessity for construction absolutely tight under pressure of ammonia, carbon dioxide, and other gases had resulted in early designs using blacksmith's forge welds, and these forge welds still continue to be used to some degree years after gas welding has been introduced and found satisfactory. One reason for the persistent use of forge welding is found perhaps in certain city ordinances governing permissible refrigeration installations.

"Prime requirements in refrigeration apparatus are pressure container strength and tight joints. Receivers, accumulators, coolers, pipes, coils and headers must be amply strong to resist the normal internal pressures applied, and all joints must remain tight under every normal condition of service.

"Before the advent of oxy-acetylene welding in the United States, about 1905, refrigeration seams and joints were made up with forge welds, rivets, screw threads, flanges, gaskets and so forth. Naturally, when oxy-acetylene welding was established as a commercial process it was taken up by progressive builders of refrigeration machinery, and applied in the fabrication of their apparatus with the object of simplifying construction and making operation more dependable.

Designers of refrigeration pressure containers find that gas welding gives them important advantages with regard to weight, durability, cost and ultimate strength. Oxy-Acetylene welded construction has worked out much to the advantage of both the manufacturere and user of refrigeration equipment."

"Domestic Refrigeration": "The tremendous popularity of domestic refrigeration is very largely due to the beautiful construction and finish of the present-day units, made possible by the intelligent application of the oxy-acetylene process.

"The demand for beautiful cabinets which can be kept scrupulously clean and sanitary has enforced the use of sheet steel for their construction.

"Sheet steel lends itself to the production of strong, beautifully-formed cases and is a very satisfactory base for the application of the attractive enamel with which many of the various types of cases are covered.

"To secure the ultimate in sanitary construction it is necessary to eliminate all joints or crevices and therefore all meeting edges are joined by butt welding with the oxy-acetylene torch to the almost total exclusion of other methods. In the effort to permit extreme cleanliness many manufacturers have standardized sizes and utilized stampings so that every internal corner is nicely rounded.

constructed welding jigs each admirably suited to the particular type of weld required. The jigs as a rule are designed so that they perform a manifold duty. The main object is naturally to securely hold and accurately position the parts for the convenient application of the welding flame. The jig also controls to a considerable extent the absorption of heat by the metal that is being welded and therefore limits the contraction and expansion of the parts and insures an accurately-sized and satisfactorily appearing product when finished. The jig is often constructed so that the parts are automatically positioned and sometimes sized, thereby assuring speed and accuracy in welding and assembling.

"Welding jigs are mainly constructed of cast iron accurately machined and sufficiently massive to avoid the possibility of distortion through continual use. Many are rather complicated in design due to the type of cabinet or the design of the component parts of the cabinet and also a considerable extent because of the location of the welds.

"Welds that enter into cabinet construction are generally rein-

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Wednesday, November 14, 1928

Address of Welcome—HOMER J. BUCKLEY, *Chairman, Advertising Council, Chicago Association of Commerce.*

Response—L. F. LOUTREL, *Shawinigan Products Corporation, New York.*

President's Address—L. E. ORDEN, *Oxweld Acetylene Company, New York.*

Secretary-Treasurer Report—A. C. MORRISON, *New York.*

Auditing Committee Report—

Address—PROF. J. D. HOFFMAN, *Purdue University*

BUFFET LUNCHEON

Wednesday Afternoon 2:30 P. M.

Report of Marine and Portable Appliance Committee—J. A. O'DONNELL, *The Presto-O-Lite Co., Inc., Chicago, Ill.*

Report of Consulting Engineer—J. I. BANASH, *Chicago, Ill.*

Report of House Lighting Committee—J. A. JOHNSON, *Crawfordsville, Ind.*

Report of Publicity Committee—H. S. CARD, *Chicago, Ill.*

Acetylene in the St. Francis Dam Disaster—J. B. Ross, *Los Angeles, Calif.* (*read by W. D. Flannery*).

Our Products in Transportation—H. THOMPSON, *New York.*

Report on Morehead Medal Award—

Presentation of Morehead Medal—W. A. SLACK, *Torchweld Equipment Co., Chicago, Ill.*

November 15 and 16

SPECIAL SESSIONS OF HOUSE LIGHTING GROUP

Thursday, November 15—2:30 to 5 P. M.
Friday, November 16—9 A. M. to 12 P. M.

Thursday, November 15, 1928—10:30 A. M.

Cutting of Structural Steel—S. W. MILLER, *Union Carbide and Carbon Research Laboratories, Inc., Long Island City.*

Report of Oxy-Acetylene Committee and Discussion—S. W. MILLER.

Bronze-Welding of Steel—I. T. HOOK, *Research Dept., American Brass Company.*

Hard Facing Metals—F. P. GORMELY, *Haynes Stellite Company, Kokomo, Indiana.*

Domestic Refrigeration—F. E. SELLMAN, *Servel, Inc., New York.*

BUFFET LUNCHEON

Thursday Afternoon, 2:30 P. M.

Joint Meeting with Gas Products Association
H. B. PIERSON, *Past-President, Gas Products Association, Presiding*

Modern Swiss Welding Practices—PROF. C. F. KEEL, *Basel, Switzerland.*

French Motion Picture—Safety in Oxy-Acetylene Welding and Cutting.

Co-operative Education and Publicity Work—Discussion opened by H. S. CARD, *Welding Engineer, Chicago, Ill.*

Friday, November 16, 1928—10.30 A. M.

Acetylene in Canada—R. WITHERSPOON, *Shawinigan Products Corporation.*

Welding Non-Ferrous Alloys—A. R. LYTLE, *Union Carbide and Carbon Research Laboratories, Inc., Long Island City.*

Mechanical Welding—J. L. ANDERSON, *Air Reduction Company, New York.*

The Effect of Tip Sizes and Pressure on Economy of Cutting—J. J. CROWE, and GEO. M. DEMING, *Air Reduction Company, New York.*

BUFFET LUNCHEON

Friday Afternoon—2:30 P. M.

The Field for Welding in the Heating and Ventilating Industry—*Prepared by the Publicity Committee of the International Acetylene Association*—Read by J. I. BANASH, *Consulting Engineer.*

Welding of Industrial Piping—J. H. ZINK, *Heat and Power Corporation.*

Welding in Commercial Refrigeration—A. F. HOESEL, *Chief Engineer, Peerless Ice Machine Co., Chicago, Ill.*

Report of Membership Committee—W. A. SLACK, *Chicago, Ill.*

New Business—

Report of Resolutions Committee—

Report of Nominating Committee—

Election of Officers—

Friday Evening—6:30 P. M.

29th Annual Dinner—Congress Hotel.

"These refinements in construction coupled with the excellent enamel finish employed requires that the highest grade of welding be performed in order that the finished product will not only be pleasing to the eye but durable to the extreme.

"It is generally conceded that when high-grade porcelain enameling is to be applied the oxy-acetylene process is indispensable. It not only takes enameling satisfactorily on all types of gas welds, but permits the welded parts to be easily finished, and because of its ductility, facilitates reforming to insure surfaces free from distortion or other blemishes encountered in sheet metal working operations.

"Manufacturers of cabinets have developed a great variety of designs and have displayed considerable ingenuity in the location and variety of welds employed in their production.

"Those manufacturers who have specialized on the higher grade cabinets have utilized almost exclusively the butt weld, so generally employed wherever gas welding is known. This means that round corners on all internal or external surfaces are possible by the use of stampings either for sides or for tops and bottoms wih flat sheets which can be bent to the required dimensions for the joining of the stampings to form the complete cabinet.

"Other manufacturers have utilized the corner weld extensively; applied by hand or by mechanical means. Corner welds as produced in refrigerator cabinet production are exceptionally strong because this type of weld permits of thorough penetration and the formation of a continuous, evenly formed bead on the inner surface of the joint. The fact that quantity production of refrigerator cabinets is the rule rather than the exception, has enabled manufacturers to equip their plants with well-designed, ruggedly

forced by the addition of welding rod or wire, with the exception of corner welds, which are made by fusing-down the sharp corner produced by the over-lapped edges to a point where the corner assumes a neat rounded appearance and of a thickness slightly greater than that of the steel sheet.

"Some manufacturers have resorted to heat- and corrosion-resisting steels for portions of the cabinets where the use of this material seems desirable. This means that various combinations of metals may be joined at certain points often by the use of Tobin bronze or other alloy, and in cases such as this gas welding proves its superiority.

"The use of the oxy-acetylene process is not confined to the production of refrigerator cabinets only, but is extensively used in the production of various parts of the refrigeration units.

"Those systems which operate on the absorption principle and which in their construction employ tanks of fair size and weight utilize gas welding extensively. Other systems which are more compactly constructed and utilize coils extensively for the transfer of heat employ welding less, but may, on the other hand, utilize the oxy-acetylene torch considerably in brazing, silver soldering or soft soldering operations.

"The oxy-acetylene torch offers a very satisfactory and speedy method of soldering or brazing in locations where other methods of heat application are at a decided disadvantage. Frequently it is found that the acetylene bunsen burner plays an important part in some assembly operations where the higher temperature oxy-acetylene flame is unnecessary.

"The vast amount of welding on these light gauge steel

cabinets has created a demand for torches of light weight and with rather large gas burning capacity, more suitable than the standard lines, and apparatus manufacturers have responded with their usual alacrity.

"So great has the demand for domestic refrigeration become that production facilities have been provided for the manufacturer of several thousand refrigerators per day and these are produced almost exclusively by the oxy-acetylene torch.

"The amazing growth of this refrigeration industry has in many plants influenced the rearrangement of the entire plant layout and necessitated the distribution of oxygen and acetylene over large areas and in unusual quantities.

"To give an idea as to the importance of gas welding in this new industry it is estimated that the quantity of acetylene used monthly, including dissolved and generated gas, is well over a million cubic feet for welding operations alone.

"Truly, it can be said that were it not for the oxy-acetylene welding process with its adaptability to all types of construction requiring welding, brazing and soldering, domestic refrigeration would not be the pleasing, reliable, economical product we know today and enjoy having in our homes."

"The Aircraft Industry": "The airplane structure is built up of a rapid, economical method of joining these parts that is essential. Several mechanical and thermal processes, such as riveting, pinning and bolting, soldering, brazing and welding, have been advocated by different constructors and used with varying degrees of success. The process of welding has been in competition with these other methods since the construction of the first airplanes. The welding on some of the first sheet metal fittings was very crude, however, and did not warrant the confidence of the engineers. The application of welding in several industries has forced the development of small, light weight equipment, increased the facilities for distributing raw materials, and produced a body of mechanics who are skilled in handling an oxy-acetylene torch. The low cost of plant equipment and the ease with which joints could be made in thin metal without elaborate designs or expensive jigs could not be overlooked by the aircraft industry. The advantages of a rigid metal framework were recognized and added further impetus to the use of welding.

"The total production of aircraft in this country in 1921 was 302. These were practically all typical wooden structures. In 1927 the production was 2,353 and it has been estimated that this year the production will be from 4,500 to 7,000. The latter figure probably more nearly represents the actual production. Approximately one-fifth will be for the Army and Navy. The remainder are commercial aircraft. Ninety per cent of these modern airplanes will have oxy-acetylene welded steel fuselages, landing chassis, tail skids, and fittings.

"The factors which have led to the increase in the use of oxy-acetylene welding in preference to other methods have been stated. The confidence of designers and constructors in the reliability of welding evolved a result of improvement in design and the eminently satisfactory service obtained with the first welded fuselage or bodies.

"There is a type of airplane structure in this country which might well be called standard. It has a welded steel tube fuselage, landing gear and tail skid. It has been developed in order to obtain strength and rigidity with minimum weight and to use methods which are applicable to small or large production at relatively low cost for material, labor and overhead.

"The safety factor in welded construction has been amply demonstrated. It has been used in the fastest racing planes and in the largest bombers and transports. Many an embryo pilot owes his escape from injury to the resilient, crashproof, military training airplane with its welded steel tube body and under-carriage. There are few well-informed aero-nautical engineers and constructors at the present time who have not been convinced that welding is a safe and reliable method for joining steel.

"The airplane of the next few years will be similar to the modern craft. Production costs will be decreased. The oxy-acetylene industry must assist the airplane manufacturer in this respect in order to maintain the present position of oxy-acetylene welding."

"Industrial Piping": "Probably no application of oxy-acetylene welding has taken any greater stride forward during 1928 than welding in the construction of industrial piping for high and low pressure steam, water, compressed air and the other industrial services. It has been treated by speakers before technical societies, discussed in many important articles in the technical press, and what is more to the point, more and more fabricators of industrial piping have standardized on welding for important work.

"Executives and engineers alike have accepted welding for piping as an answer to the problem of leaky joints and have found not only that maintenance costs are reduced, but even that installation costs are lower with welded piping.

"In some sections of the country contract welding shops have undertaken to learn the best methods for handling this type of work, with the result that some of them have developed an important business in the construction of welded piping."

H. C. Whittemore, Chief Engineer, Mechanics Division, U. S. Bureau of Standards, Awarded Morehead Medal at 29th Annual Convention of International Acetylene Association.

"Heating and Ventilating": "While the presence of cylinders and oxy-acetylene equipment on all large building jobs has long been commonplace, the casual observer can hardly realize the rapidty with which the process has grown or to how many phases of construction it has extended in a very short period.

"One of the most important steps it has taken is that of welding pipe joints for high and low pressure steam and for water and gas service in all types of buildings where extensive piping systems are used.

"Oxy-acetylene welding is gaining headway in this field principally because of the marked superiority of a welded joint over a mechanical joint, thus insuring greater freedom from leakage and adding greatly to the life of the installation. The welded system also gives greater efficiency because of better

circulation and has the added advantages of economy of space and of better appearance.

"The foregoing advantages being almost immediately obvious, the most natural question in the contractor's mind is that of comparative costs. It is safe to say that for any but the smaller sizes of pipe the cost of welded joints is less than that of mechanical joints and the economy is greater as the size of pipe increases. Aside from the actual economy of welding if the installations are compared joint for joint, the elimination of heavy and expensive fittings, the ease with which pipe can be cut and joined as desired, and the excellence of the job when completed are all factors in favor of welded pipe joints.

"The simplicity and portability of the equipment and the comparatively short time in which the pipe fitter can be trained to do acceptable pipe welding have appealed to the contractors in this industry and have encouraged many of them to undertake the process on a small scale until they have had an opportunity to observe its full worth. While it was only natural that the unions, as well as contractors, designing engineers and architects, would move cautiously in the adoption of a practice that is so radically different from the methods long in vogue, great credit should be given the progressive members of their organizations for their ability to recognize the advantages of welding in the plumbing and heating field for their cooperation in revising specifications and in accepting the assistance of the oxy-acetylene industry in training operators to perform the work.

"While we all recognize the possibilities for pipe welding in large buildings and industrial plants, few have fully grasped the possibilities for residences and small apartment houses. Even though the lines are small and the welds comparatively few in number, welding can be almost universally adopted to the advantage of owner and contractor. Another phase is the use of oxy-acetylene equipment in cutting out old installations and in remodeling those that have been previously installed. The difficulty of accomplishing such work by the older methods of pipe fittings are well known, and it is obvious that the cutting torch and the welding torch are logical tools for such cases, whether the work may be small or great in extent.

"When we realize that hundreds of miles of pipe are being installed in public buildings, industrial plants and residences each year, and that most of these lines are now joined with mechanical fittings when a welded joint could be used to advantage, we get an idea of the possibilities that are to be looked for in this field, and that can be developed by the proper educational programs."

There is one field of application for gas welding which is developing so rapidly that practically all of one session was devoted to it; that is, the heating and ventilating industry. The keynote paper of this session was read by J. I. Banash, Consulting Engineer, Chicago, who said in part:

"This is a large market and an indication as to its size is readily available in the estimate of the Copper and Brass Research Association that out of every dollar spent for building 9.3 cents buys plumbing and 7 cents buys heating, a total of 16.3% of the total building cost. With new building maintaining a better than $6,000,000,000 volume each year, the expenditures for plumbing and heating amount to about $1,000,000,000 annually.

"The plumbing and heating contractor receives more of the building dollar than any other artisan or craftsman except the carpenter. As further indication of the breadth of this market reliable authorities consulted estimate that out of a total of 2,000,000 tons of wrought iron and steel pipe produced annually, three-fourths of a million tons of this pipe comes into the plumbing and heating industry. There are approximately 350,000 tons of pipe fittings of various kinds used in the industry annually. In the year 1926, 3,924,074 pieces of enameled iron sanitary ware were sold through the plumbing and heating contractor, and 251,000 tons of cast iron heating boilers, round and square, together with 172,188,000 sq. ft. of radiation were sold, and approximately 6,000,000 pieces of tubular brass goods for brass faucets.

"From reliable sources consulted, the labor element presents no difficulties whatever for welding, inasmuch as the majority of the larger local unions already have competent steamfitters carrying local union cards who also do welding. If a contractor, as an example, gets a job on which he has figured welded construction and at that moment does not have a competent welding steamfitter in his organization all he has to do is to call the secretary of the local steamfitters' union, explaining the case, and he will be furnished with a steamfitter who is competent to do any welding required on the particular job.

"The applications of welding in the industry are very wide. In practically every piece of material the contractor handles involves metals ranging from cast iron to admiralty tubing. Therefore, since the plumbing and heating industry is essentially metallic it presents a very wide market for welding and cutting equipment and gases. It is apparent that the market for gases alone represents an astounding figure annually based on normal consumption of average contractors. In addition to this there is also an important market for welding apparatus."

Mr. Banash's talk was followed by a paper on "The Welding of Industrial Piping," by J. H. Zink, Heat & Power Corporation; another on "Welding and Commrecial Refrigeration," by A. F. Hoesel, Chief Engineer of the Peerless Ice Machine Company, Chicago.

Another indication of the importance placed on educational activities in association work is seen in a joint meeting which was held Thursday afternoon with the Gas Products Association, presided over by Mr. H. B. Pearson of Chicago, Illinois, past president of the Gas Products Association. The introductory paper of this joint meeting was an interesting description of modern Swiss welding practices by Professor C. F. Keel, Basel, Switzerland, a noted European authority on welding subjects. Professor Keel's paper was followed by a general discussion of cooperative educational and publicity work, the object of this discussion being to make clear to all members what facilities were available for helping industrial executives to get easy access to information regarding the proper use of the oxy-acetylene processes.

An interesting feature of the program was the presentation of the Morehead Medal. This Medal was established several years ago as an anuual award for contributions of outstanding merit to the development of the use of carbide and its derivatives. The Medal is provided for by Mr. James M. Morehead in memory of his father, James T. Morehead, who is recorded as the founder of the carbide industry in this country. This year the Medal was awarded to H. L. Whittemore of the United States Bureau of Standards. Mr. Whittemore has for many years shown an impartial and inspiring interest in the development of oxy-acetylene welding practice. His counsel on the problem of developing of test procedures which would indicate the true value of oxy-acetylene welding in important constructions, has been of the utmost value to the industry.

Space does not permit detailed comment on all of the papers read before this Convention. A complete copy of the program will, however, be found on the second page of this article. It is expected that several of the papers will be available for publication in full in later issues.

Bending Tests on Welded Steel

Standard I-beams, Butt-Welded, and With Splice Plate on Bottom Showed Greater Resistance to Bending Than Equivalent Length of the Structural Member Itself

AN interesting contribution to the data on strength of welded structures has been made available through the courtesy of the Electric Arc Cutting & Welding Co., Newark, N. J. In the booth occupied by this company at the National Metal Exposition last month there were exhibited several welded I-beam assemblies similar to that shown in the accompanying photograph. These assemblies were made for a series of tests conducted at the testing laboratories of Columbia University, New York City. The purpose of the tests was to show the effect of bending loads on full size structural beams as compared to the effect of the same loads on beams of the same size, butt-welded together by the metallic arc process, with a splice plate welded to the joint in different positions. A study of the table developed by the tests shows that the welded assemblies had greater resistance to bending than the original beam, and also that when failure occurred all welds were found intact. The complete report follows:

Welder at Work on Test Specimens.

REPORT OF COMPARATIVE TRANSVERSE BENDING TESTS ON WELDING 20-INCH I BEAMS FOR THE ELECTRIC ARC CUTTING AND WELDING CO., 152-156 JELLIFF AVE., NEWARK, N. J.

Report No. 1954—September 21, 1928

General

The tests recorded herein were made upon three Carnegie 20″ I 65.4 lb. beams, 12 feet long. One of these beams was continuous and not spliced. The other two beams had been connected at mid-length by welding. The method of connecting the two sections of these beams was as follows:

Specimen No. 2. This specimen consisted of two six feet lengths of 20″ I 65.4 lb. beams butted together at the ends and joined by arc welding in which metal was deposited across the joint on both sides of the beam. This welding metal was deposited across the joint over the full depth of the beam including the upper flange, web, and top of the lower flange. In addition to the deposition of metal across the joint, a ¾″x6¼″x24″ steel plate was welded to the lower flange, as a splice plate, this plate being attached to the bottom of the flange, by welding along the outside edges.

Specimen No. 3. This specimen consisted of two six foot lengths of 20″ I 65.4 lb. beams butted together at the ends and joined by depositing welding metal across the joint on one side of the beam and by attaching a splice plate across the joint on the other side. On the side joined by the deposition of welding metal across the joint the method was similar to that of beam No. 2. On the other side, the upper flange was again connected by the deposition of welding metal, but the web was connected by a ½″x17½″x24″ splice plate welded to the flange fillets along the top and bottom edges, and welded to the web at each end of the plate for a length of 5½ inches at the center of the web (i. e., not a continuous weld along the edges for the full height of web). In addition to the above connection a ¾″x8″x24″ plate was welded to the bottom of the lower flange by welding along the outside edges, thus connecting the edges of the flange to the plate.

Plate I attached herewith gives the dimensions of the connections described above.

The specimens tested were submitted by the Electric Arc Cutting & Welding Co. The tests were witnessed by Mr. Gilbert Serber, C. E., and Mr. M. Stadtfield, Assistant Engineer, Board of Transportation, New York, N. Y.

Method of Test

Each of the beams was supported on rocker supports with a span of eleven (11) feet, center to center of supports. These supports provided a four (4) inch bearing across the full width of the flange. Load was applied by a 400,000 lb. Olsen Testing Machine at mid-span. The load was distributed to steel blocks 4 inches wide laid across the upper flange and spaced 6 inches apart, thus actually resulting in two

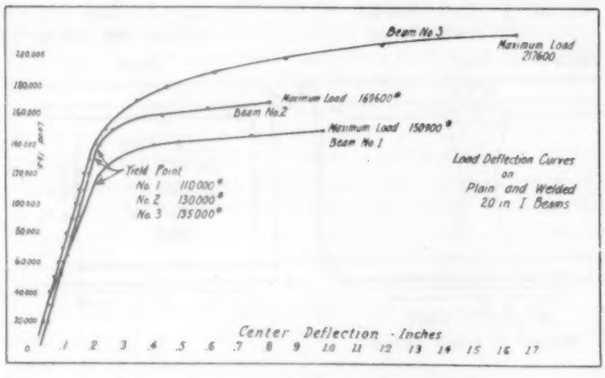


Plate I—Graph of Results of Bending Tests.

concentrations close together at mid-span. This method was adopted in order to insure a uniform bearing in the case of the welded beams which had welding metal over the joint on the top of the upper flange rather than apply the load directly to the weld. The bearing blocks thus straddled the weld. The continuous plain beam was tested with the same load application for comparison.

Deflection of the beam was measured by means of a fine steel wire kept taut between points on the lower flange directly over the support and steel scale reading to 0.01 inch attached to the lower flange at mid-span. The center deflections were recorded at increments of 10,000 lb. applied to the beams.

Load was continued until buckling was produced, i. e., maximum load.

Results of Tests

The following tables give the loads and corresponding center deflections as recorded during these tests. Accompanying this report these data are shown graphically by curves on Plate II.

LOG OF TRANSVERSE BENDING TESTS ON 20-INCH I 65.4 LB. CARNEGIE BEAMS

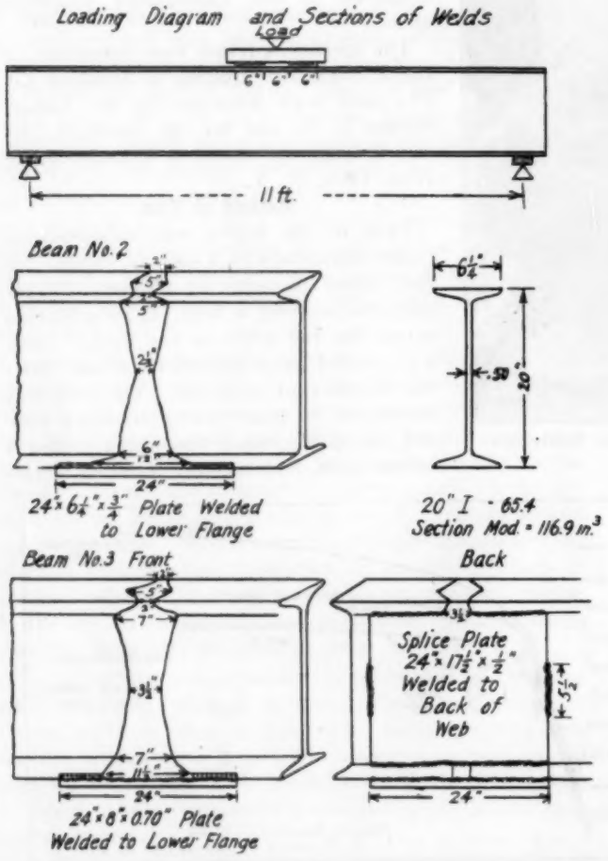
Test No. 43656.

Specimen No. 1—Plain Beam, Continuous.
Span, 11 Feet.
Loading, Central.

Applied Load Lb.	Center Deflection Ins.	Applied Load Lb.	Center Deflection Ins.
10,000	0	90,000	.15
20,000	0	100,000	.175
30,000	.04	110,000	.195
40,000	.055	120,000	.225
50,000	.06	130,000	.27
60,000	.095	140,000	.41
70 000	.11	146,000	.74
80,000	.13	150,000	.99
		150,900 Max. Load	1.24
		Permanent Set	1.00

Remarks: Beam failure. Pronounced Center Buckle in top flange.

Loading Diagram and Sections of Welds


Load
11 ft.
Beam No. 2
24" x 6¼" x ¾" Plate Welded to Lower Flange
20" I - 65.4
Section Mod. = 116.9 in.³
Beam No. 3 Front
Back
Splice Plate 24" x 17½" x ½" Welded to Back of Web
24" x 8" x 0.70" Plate Welded to Lower Flange

LOG OF TRANSVERSE BENDING TESTS ON 20-INCH I 65.4 LB. CARNEGIE BEAMS

Test No. 43657

Specimen No. 2—Welded Beam with metal deposited on both sides and plate welded to bottom flange.
Span, 11 Feet.
Loading, Central.

Applied Load Lb.	Center Deflection Ins.	Applied Load Lb.	Center Deflection Ins.
10,000	.01	100,000	.145
20,000	.04	110,000	.16
30,000	.055	120,000	.18
40,000	.06	130,000	.20
50,000	.08	140,000	.22
60,000	.09	150,000	.265*
70,000	.10	160,000	.44
80,000	.11	165,000	.59
90,000	.13	169,600 Max. Load	.81
		Permanent Set	.59

Note: *Start of slight top flange Buckle.

Remarks: Beam failure. Pronounced Center Buckle in top flange.

No visible effects in weld.

LOG OF TRANSVERSE BENDING TESTS ON 20-INCH I 65.4 LB. CARNEGIE BEAMS

Test No. 43658.

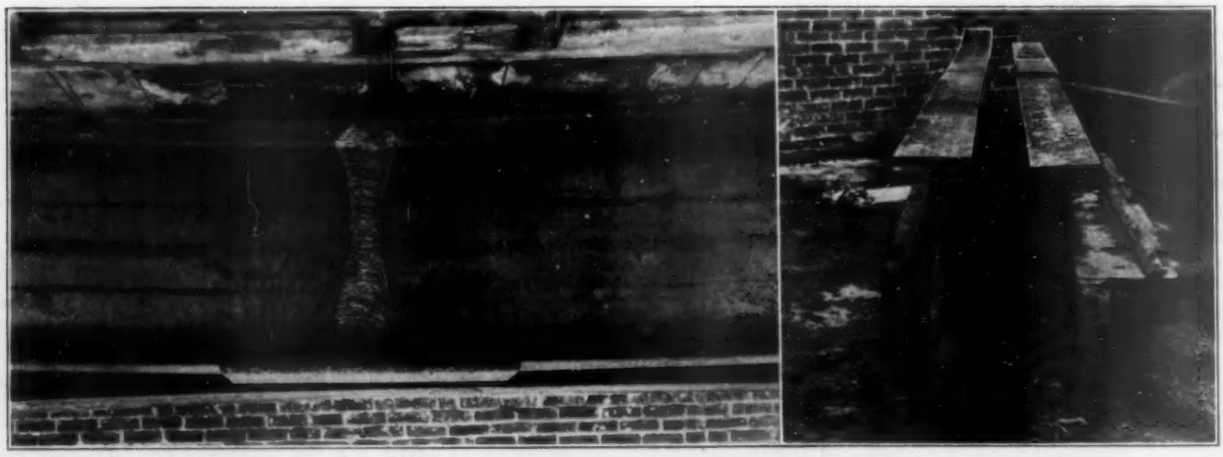
Specimen No. 3—Welded Beam with metal deposited on one side and splice plate welded to other side and plate welded to bottom flange.
Span, 11 Feet.
Loading, Central.

Applied Load Lb.	Center Deflection Ins.	Applied Load Lb.	Center Deflection Ins.
10,000	.01	130,000	.195*
20,000	.03	140,000	.21
30,000	.04	150,000	.24
40,000	.05	160,000	.35
50,000	.06	170,000	.35
60,000	.075	180,000	.45
70,000	.095	190,000	.62
80,000	.11	200,000	.86
90,000	.125	209,000	1.18
100,000	.14	210,000	1.19
110,000	.15	215,000	1.40
120,000	.165	217,600 Max. Load	1.65
		Permanent Set	1.30

Note: *Start of slight buckle in top flange on one end.

Remarks: Web buckling on one end from center toward end accompanied by pronounced top flange buckle on same end in a direction away from the side with the splice plate. Slight buckle in bottom flange in opposite direction to that of top flange. No visible effects in weld.

Respectfully submitted,
Testing Laboratories,
Per
W. J. Krefeld,
Engineer of Tests.



Test Specimens Made to Show the Effect of Bending Loads with Splice Plates Welded to the Joint in Different Positions. Plate Shown at Right Is Upside Down. No Plates Were Welded to the Top Flange.

Formula for Working Fiber Stresses*

Since Stresses to Which a Structure Is Subjected in Service Cannot Be Definitely Fixed the Designer Has to Use Judgement in Selecting a Safety Factor—A Formula Is Offered

By S. W. Miller†

THE question of what working fiber stress should be used in designing any structure has always been in the minds of engineers. Economy demands the least possible amount of material, while safety urges the engineer in the other direction—that is, to put plenty of material in so that the structure will surely be safe. The allowable fiber stress depends somewhat on the conditions under which the structure operates, but it seems evident that the most important thing to be considered is that in service the structure must not permanently distort under any stress that may be applied to it. There are cases in which a reasonable amount of temporary distortion is permissible, and other cases in which such distortion must be limited. For instance, a steel I-beam will stand without danger a certain load, but in many cases the deflection due to that load is too great to permit it to be used in a plastered ceiling if the plaster is expected not to crack, though in neither case is the metal in the I-beam permanently distorted. Permanent distortion cannot be allowed.

Steel has the property of perfect elasticity under stress up to a certain point, which is called by various names, such as yield point, proportional limit, and elastic limit, all of which are very close together in amount when measured, as usual, in pounds per square inch, and which are really variants of what we call elasticity—that property of matter which causes it to return to its original dimensions after it has been deformed. Evidently, structures in service must retain their elasticity to be of value. To be accurate, the above can be applied only to material that is homogeneous. Actually, there is no such material, but if we had it we could rely on its elasticity being the same in all parts and in all pieces. Fortunately, good steel is sufficiently homogeneous to enable us to design and build structures that are perfectly safe in service.

If we know in any particular case the exact maximum stress to which a structure would be subjected in service, and if we had homogeneous material, we could use in the design of the structure a stress very close to the point at which the law of elasticity fails. However, we cannot know the stresses to which a structure is subjected in service, nor do we have homogeneous material. We are, therefore, forced to use in our design a less stress than that referred to—how much less depending purely on experience and the judgment of the designer.

The ratio of the theoretically possible stress to the one actually used may be called a factor of safety. Usually, however, the factor of safety is taken as the ratio between the ultimate strength of the material and the actual working fiber stress selected.

Let us consider the case of mild steel of an ultimate strength of 55,000 lbs. per sq. in., having a yield point of 35,000 lbs. per sq. in. According to the previous argument, if the material were homogeneous and we were sure that no greater strength than 34,000 lbs. per sq. in. would ever be applied to it, we could safely use a design fiber stress of 34,000 lbs. As a matter of fact, in this country, when such material is used for boilers, a working fiber stress of only 11,000 lbs. is permitted by the A. S. M. E. Boiler Code, while for the same material in locomotive boilers a stress of 12,200 lbs. is permitted, and in England for stationary boilers 13,750 lbs. is allowed. All of these are below the yield point of the material, but even the highest of them is nowhere near the yield point. The highest is 25 per cent greater than the lowest, and it may well be asked what reason is there for this 25 per cent variation. I am perfectly willing to admit that I do not see any, and I do not believe that any other conclusion can be reached than that we are, in this country, following a custom of many years' standing without any definite knowledge on which to base our design.

I do not intend in any way to condemn the use of a factor of safety of 5 in boiler construction. My only purpose is to point out that our factors of safety are not based on definite knowledge that we rightfully should have. It is very probable that the factor of safety of 5 used in boiler construction is on the safe side.

I think that it will be admitted by everyone that a certain amount of ductility is necessary in any structure subjected to unknown stresses, although we have no definite information as to the minimum amount needed in any particular case, except that we find from our experience that a certain structure, having a certain ductility in its material, has proven safe. In ordinary steel construction work (and I am not referring to the case of structural steel so-called), it may be said that as a general rule the factor of safety used in design is 5. In the case of structural steel in buildings, the usual factor of safety is about 4, and 16,000 lbs. is the usual design fiber stress. It is well known that this is considered by many engineers to be lower than is necessary, and there is a strong movement to increase it to 18,000 lbs. But let us assume for the present purpose that the customary factors of safety referred to above are all right, and that whatever the reasons may be, it is not desirable to change them.

In welded construction in which mild steel is used, of course the same problems of design are encountered as with other types of joints. We must assume, in discussing welded joints, that we are talking about properly made ones, because we cannot admit that we would base any design on bad material or construction. Assuming that proper procedure is followed in making, for example, a welded pressure vessel, we can have no doubt as to the tensile strength of the weld metal or of the base metal, because these can be easily determined by the tensile test. This has been done numberless times, and many results have been published. In a general way, it can be said that this tensile strength runs from 45,000 to 75,000 lbs. per sq. in., depending on the welding rod and process used, and this refers to welds that have not been heat treated. With mild steel plate, then, there is evidently no difficulty in obtaining sufficient tensile strength in the weld to break the plate.

It should also be understood that these figures refer to tests made with the reinforcement on the welds ground off. We are not concerned in the present discussion with what may be done in the way of strengthening the weld by reinforcing,

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but only with the strength of the weld metal. If a welded test piece with no reinforcement breaks outside the weld, it is obvious that the weld is stronger than the plate, and that so far as tensile strength is concerned, we will be perfectly safe in using this figure for the tensile strength of the weld metal, so that we can safely use the breaking strength of the test piece (regardless of whether the rupture occurred in or out of the weld) for our present purpose.

The ductility of welds also varies with the welding rod and the process of welding, but it would seem perfectly fair, and indeed almost obvious, that two welds made by different processes or with different rods, but which have the same tensile strength and ductility, should be allowed the same working fiber stress, for the present disregarding its amount.

The measurement of the real ductility of weld metal is impossible in an ordinary welded tensile test piece, because the yield point of the weld metal in mild steel, when its tensile strength approximates that of the plate, is always higher than the yield point of the plate, so that during the tensile test the base metal elongates and begins to neck down before the weld metal does. As an illustration, the yield point of the majority of welds is in the neighborhood of 42,000 to 45,000 lbs. per sq. in., while the yield point of ordinary mild steel is about 35,000 lbs., and as most of the elongation in any tensile test piece occurs during the last few thousand pounds of the load, the result is a comparatively small elongation in the weld metal, its real ductility not being shown. For instance, certain weld metal has an ultimate strength of 70,000 lbs. per sq. in. and an elongation of 25 percent in 2 inches in a standard .505-in. test piece. Nothing like this elongation can be obtained in an ordinary welded tensile test piece, as the results will show only about 10 per cent elongation in 2 in. over the weld, and much of this 10 per cent is in the bast metal.

We have studied this question rather thoroughly in our laboratory, with the result that a properly made bend test is found to show much more closely the actual ductility of weld metal. The essential feature of the test is that there must be no restraint at the bend during its making, which is done by slightly kinking the piece at each end somewhat outside the weld, say an inch or so from it, and then bending it endwise as a column in a testing machine, vise or press.* At the first sign of cracking, the bending is stopped, and the distance between the gage marks previously laid out in the weld metal again measured, the elongation being measured the same as in th usual tensile test. This being also a test of the weld metal, the reinforcement should be ground off.

There is no great difficulty in bending test pieces ½ in. thick in an ordinary heavy vise, but with thicker material the facilities usually at hand are not sufficient. In such cases, a piece is taken from the top of the weld or the bottom, or both, of suitable thickness, say ⅛ in., which piece is bent in the usual manner.

It is quite common, although not universal, to record in a tensile test the per cent reduction of area, and many engineers believe that this is a better measure of ductility than the elongation as usually given. It is interesting to note that the bend test combines both the elongation and reduction of area, and for this reason is a better measure of the ductility, in my judgment, than pure elongation. After all, the elongation measured in 2 in. or 8 in. does not give a true idea of the ductility of the metal. In an 8-in. test piece, the original inch in which the greatest elongation takes place may have stretched in mild steel as much as 90 per cent, while the total elongation may be 30 per cent. The elongation also depends on the geometry of the test piece. The reduction of area, taking place in a short distance, is not subject to these variations, so that any test that includes even a portion of the usual reduction of area, gives, to my mind, a fairer measure of the ductility than the result that is based on the usual elongation figure. I believe this to be true, not only of weld metal, but of all metals.

In any case, the bend test seems to be the only method by which the ductility of the weld metal can be determined with reasonable accuracy, so that if the results of this test could be combined with tensile strength in some way, it would seem that reasonable decisions could be made as to the proper fiber stresses that could be allowed in welds of different kinds.

As there seems to be no theoretical basis for a working fiber stress, it is necessary at present to depend on practical results for the development of any formula that would be used for the purpose. If we know that certain fiber stresses have been used successfully with welds of certain tensile strength and elongation as measured by the bend test, we can create a formula to cover these results. Of course, the more figures we have the more accurate will be the formula, which undoubtedly is true of any formula that is empirical; but an additional element of accuracy that it is fair to consider is the opinion of engineers based on their experience as to allowable fiber stresses for different kinds of welds. The tensile strength and elongation of such welds can be determined, and the formula checked against them.

It would also seem fair that the formula should take account of ductility in such a way that a lower working fiber stress would be allowed where the material has low ductility, and that the working fiber stress should depend directly on the tensile strength.

Such a formula has been devised by Mr. A. B. Kinzel, and is as follows:

$$S = \frac{T}{7.15}\sqrt[3]{\frac{E}{10}}$$

in which S is the allowable working fiber stress, T the ultimate tensile strength, and E the percentage of elongation as determined by the bend test before referred to.

Using different values for T and E, Table 1* has been prepared. The factor of safety in the last column is the same for any given percentage of elongation. The ultimate strength is either that of the weld metal if the weld breaks during the test, or of the base metal if the fracture occurs in it, and obviously a structure cannot be designed, as far as tensile strength is concerned, except on the strength of the weakest part. It is easily worked out that a factor of safety of 5 is reached at an enlongation of somewhat over 29 per cent.

Any change in the constant, 7.15, would change the fiber stress in direct proportion. For instance, if 7 were taken instead of 7.15 the difference would be only 2 per cent, which is evidently of practically no effect. The only reason why 7.15 was used is because it fits more closely the results of the tests on which the formula is based.

The part of the formula covering the factor of elongation decreases the allowable working fiber stress more rapidly than the elongation decreases, and on the other hand, increases the fiber stress more slowly than the elongation. This seems quite logical, because there must be a point beyond which an increase in elongation increases the value of the metal but slightly, and because as the brittleness increases, the metal becomes less reliable in service.

It may be asked why some other root than the cube root was not used in the preparation of the table. It is because the cube root seemed to fit the facts better than did any other. Table III compares the results by using the square root, and the fourth root with the results of Table I. It will be noticed that while there is not so much difference in the central part

*Paper by A. B. Kinzel read at the September, 1927, meeting of the American Society for Steel Testing in Detroit, Michigan. See also paper by W. B. Miller in the Journal of the American Welding Society for September, 1927.

*The figures in this table are determined by the slide rule, and are taken to the closest one hundred pounds.

of the table, yet at the extremes, both of tensile strength and elongation, there is a large difference. The figures for the square root formula are about 12 per cent less for 45,000 lbs. and 5 per cent elongation, and for the same basis about 6 per cent greater for the fourth root. At the other end of the table, for 75,000 lbs. and 25 per cent elongation, the square root gives an increase of about 17 per cent and the fourth root a decrease of about 7 per cent. In this connection the factors of safety given in the last column are of interest. Of course, the factor of safety is the same for any one horizontal line. These factors of safety become 5 at 20 per cent elongation for the square root formula, at about 29 per cent for the cube root formula, and at about 42 per cent for the fourth root formula.

With our rather conservative ideas as to the use of factors of safety, it looks as if the fourth root formula gave too low a factor of safety, and that if a weld were produced with 29 per cent elongation and 75,000 lbs. ultimate strength, the factor of safety of 5 would not be unsafe, so that the cube root seems to be reasonable and to conform to general engineering ideas.

The allowable working pressure in the Power Boiler Code is based on the minimum ultimate strength of the plate of 55,000 lbs. per sq. in., the efficiency of the joint, and a factor of safety of 5, so that 11,000 lbs. is the allowable working fiber stress.

In the Pressure Vessel Code, while the allowable fiber stresses are really based on a factor of safety of about 5 for riveted construction, a definite fiber stress of 10,000 lbs. is permitted for plates less than 55,000 lbs. ultimate strength, and 11,000 lbs. for plates of 55,000 lbs. or greater ultimate strength. So it might be feasible to simplify the table by adopting some plan similar to that in the Pressure Vessel Code, and Table II is submitted as showing what might be done in this direction.

Also, it may be unnecessary to make such small steps as Table I shows when the factors of safety are as large as they are, and when the tanks are tested to three times the working pressure. It is also true, with welding as it is with riveting, that no two joints are exactly the same, and that allowable commercial differences in welding rods will have some bearing on the physical properties of the weld metal. Therefore, some such form as Table II may be allowable.

In practice, proper procedure requires that the welders be tested. If the manufacturer had on file certified records of the welders, the inspector could check these records with the tanks that are being built, and by the use of the table could decide on the maximum allowable working pressure.

Table I gives higher values for welds than have ever before been presented for consideration, but no higher than have actually been used in practice with safe results in the cases on which the table is based. It is not believed that they can be used without proper procedure control, but it is felt that they are perfectly safe when such procedure control is followed in the construction of the tank.

It is rather interesting that it so happens that the allowable fiber stress at 50,000 lbs. and 5 per cent elongation is 5,600, the same as is used in the Pressure Vessel and Heating Boiler Codes.

At the values of tensile strength and elongation of cast iron, say 20,000 lbs. and 0.2 per cent, the formula gives a fiber stress of 750 lbs. As a common factor of safety for cast iron under shock is 20, the formula does not seem to be unreasonable at this extreme.

At the other end, we may take nickel steel that has been used for boilers. It has a tensile strength of 70,000 lbs. and an elongation of 23 per cent (obtained by the tensile test and not by the bend test). The formula rating for this material is 12,900 lbs., and with a factor of safety of 5 it would be allowed 14,000 lbs. working stress. Therefore, it seems that the formula is within reason and does not violate good practice, even at the extremes.

TABLE I

Proposed Maximum Allowable Working Fiber Stresses in Lbs. Per Sq. In. of Plate Section for Welded Steel Pressure Vessels.

% Elongation by Bend Test	Ultimate Strength in Thousands of Lbs. Per Sq. In.							Factor of Safety
	45	50	55	60	65	70	75	
5	5000	5600	6100	6700	7200	7800	8300	9.
7½	5800	6400	7000	7700	8300	8900	9600	7.8
10	6300	7000	7700	8400	9100	9800	10500	7.15
12½	6800	7600	8300	9000	9800	10500	11300	6.65
15	7200	8000	8800	9600	10400	11100	12000	6.25
17½	7600	8400	9300	10100	11000	11700	12700	5.9
20	8000	8800	9700	10600	11400	12300	13200	5.7
22½	8300	9200	10100	11000	11800	12800	13700	5.5
25	8600	9500	10500	11400	12400	13200	14200	5.3

TABLE II

Per Cent Elongation by Bend Test	Ultimate Strength in Thousands of Lbs. Per Sq. In.						
	Over 45 up to 50	Over 50 up to 55	Over 55 up to 60	Over 60 up to 65	Over 65 up to 70	Over 70 up to 75	Over 75
5 to 7½	5400	6000	6500	7200	7700	8300	8900
Over 7½ to 10	6000	6700	7300	8000	8700	9300	10000
Over 10 to 12½	6500	7300	8000	8700	9400	10100	10900
Over 12½ to 15	7000	7800	8500	9300	10100	10800	11600
Over 15 to 17½	7400	8200	9000	9800	10700	11400	12300
Over 17½ to 20	7800	8600	9500	10300	11200	12000	12900
Over 20 to 22½	8200	9100	9900	10800	11600	12500	13400
Over 22½ to 25	8500	9400	10300	11200	12100	13000	23900

TABLE III

Per Cent Elongation by Bend Test	Ultimate Strength in Thousands of Lbs. Per Sq. In.							Factor of Safety
	45	50	55	60	65	70	75	
5	4450	4970	5500	5950	6450	6950	7500	10
	5000	5600	6100	6700	7200	7800	8300	9
	5300	5950	6500	7100	7600	8250	8850	8.5
7½	5500	6100	6700	7300	7900	8500	9150	8.2
	5800	6400	7000	7700	8300	8900	9600	7.8
	5900	6550	7200	7850	8500	9150	9900	7.6
10	6300	7000	7700	8400	9100	9800	10500	7.15
	6300	7000	7700	8400	9100	9800	10500	7.15
	6300	7000	7700	8400	9100	9800	10500	7.15
12½	7100	7800	8600	9400	10200	11000	11800	6.35
	6800	7600	8300	9000	9800	10500	11300	6.65
	6700	7400	8150	8900	9650	10400	11200	6.7
15	7900	8800	9700	10600	11500	12300	13200	5.7
	7200	8000	8800	9600	10400	11100	12000	6.25
	7100	7800	8600	9400	10200	11000	11800	6.35
17½	8300	9250	10200	11200	12000	12900	13800	5.35
	7600	8400	9300	10100	11000	11700	12700	5.9
	7250	8050	8850	9600	10400	11300	12100	6.2
20	8950	9950	10900	11900	12900	13900	14900	5.05
	8000	8800	9700	10600	11400	12300	13200	5.7
	7500	8300	9150	9950	10800	11600	12500	6.0
22½	9250	10500	11500	12600	13600	14700	15800	4.75
	8300	9200	10100	11000	11800	12800	13700	5.5
	7700	8600	9400	10600	11200	12000	12900	5.8
25	10000	11100	12200	13600	14300	15500	16600	4.5
	8600	9500	10500	11400	12400	13200	14200	5.3
	7950	8800	9700	10600	11500	12300	13200	5.7

G-E ADVERTISEMENT PROPHESIES SILENT ERECTION OF STEEL STRUCTURES

The General Electric Company has been publishing in national magazines a series of advertisements for the purpose of promoting a wider use of electricity. These are appearing in a number of well known periodicals with large circulations, and thus are reaching a great majority of the American public. Among this series is one devoted to a prophecy of the silent erection of steel buildings by means of the electric arc. It puts before millions of people the idea that such construction can be carried on without noise, swiftly, easily, and at considerable savings in cost; and that electric welding performed by experts knits metal together with joints as strong as the metal itself.

$25.00 REPAIR SAVES HUNDREDS

Some time ago a Western foundry had occasion to purchase a large air compressor from an Eastern firm. When the compressor was set up in the plant it was found that it had been damaged so badly in transit that when put in operation the cylinder wall leaked, and instead of pumping air it pumped water.

Inspection of the damaged compressor by the plant manager showed that the water was coming from a crack in the cooling water jacket with which air compressor cylinders of this type are usually cast.

Here was a job for the plant welder. He immediately dismantled the compressor, and after first veeing the crack in the cylinder wall, which extended between the two intake air ports, he slung the casting on an overhead trolley and ran

Several Weeks' Time and Hundreds of Dollars Saved in a Few Hours by Welding.

it out into the yard. Next a small brick preheating furnace was built under the suspended piece. A charcoal fire was lit and the preheating flames confined to the damaged portion only. After sufficient heating of the cast iron piece, welding was begun. A good quality of cast iron rod and flux were used. The job was completed in a few hours without difficulty.

Estimates of the amount of time and money saved in this repair job were very gratifying. The plant suffered only a few hours shut down and the total repair cost was but a trifle over twenty-five dollars. Under the old method of scrapping and replacing with new parts, a delay of several weeks would have been entailed and an expenditure of several hundred dollars for a new part.

ICE MACHINE DESIGN MARKS TREND TOWARD STEEL CONSTRUCTION

A radical departure from the traditional design of small capacity ice machines is shown in new ammonia refrigerating equipment recently put on the market by the Mansfield Ice Machine Company, Mansfield, Ohio. This new ice machine ably demonstrates what can be accomplished with steel in standard shapes and at a cost considerably below the cost of cast iron construction.

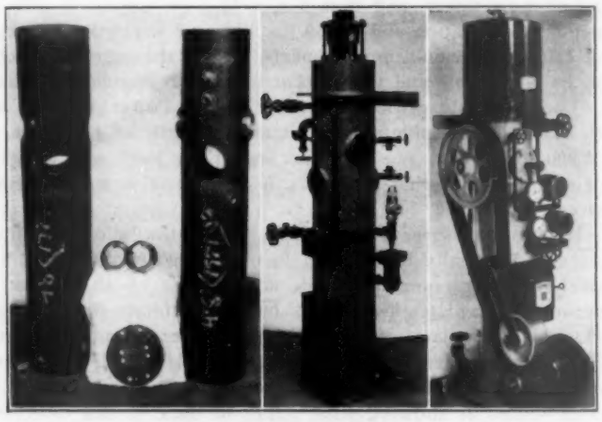
In designing this machine the engineer disregarded all precedent and starting with a clean slate, has produced a machine which is thoroughly modern in every respect. Before a single part was even drawn up, the function of that part was thoroughly analyzed, then the part was designed in the simplest possible manner to meet the necessary requirements.

It is natural that the resulting design should differ in appearance from corresponding parts in machines of older design. Each part, however, serves its function as well or better than parts designed to be manufactured in the conventional manner.

Methods of manufacture are factors that are equally important as the material used in making the improved design practical. By use of the electric arc welding process standard stock shapes of steel are made into machine parts that are lighter yet stronger and more serviceable than cast steel or iron. Economically, welded steel construction has a marked advantage over castings as it involves little overhead expense compared to that of maintaining a foundry, foundry equipment and patterns, and pattern storage.

The advanced design of the Workrite ice machine was made possible only through the use of arc welded steel construction. The mechanical advantages resulting from the new design and construction are a reduction in size and weight, and higher compressor efficiency. The weight of the new machine is reported to be less than half of the weight of the best designed cast iron machine.

With the exception of the compressor pistons and the fly



All Former Ideas of Design Were Discarded and the Principle of Redesign Was Applied in the Construction of This Ice Machine.

wheel the entire machine is made of steel. The connecting rods and crank shaft of the ammonia compressor are of course steel forgings, the balance of the parts being made from stock steel shapes such as round bars, plate, pipe, drawn seamless tubing and structural shapes.

By welding steel plates in the ends and the inside of a piece of 10 inch steel pipe 56 inches long the compressor housing and ammonia receiver for a refrigerating unit of 1,100 lbs. ice melting capacity is formed as shown in one of the accompanying photographs. Sections of drawn seamless tubing ar arc welded together to form the removable cylinders of the compressor. The cylinder head is composed of two pieces of steel plate arc welded together. The removable head is held down by bolts screwed into threaded sections of round bar stock welded to the top of the crankcase. These arc welded items can be noted in the view of a partially completed machine. All the permanent pipe connections are also welded. The machine base and brackets and the motor base are built from standard structural shapes assembled by welding and attached to the shell by the same process.

The bearing ends of the compressor crankshaft are welded to the forging. Even the wrist pin connection end of the piston rods are sections of steel tubing welded to the forged rod. Another part which is built up by welding various pieces of steel together is the water tight housing of the condenser coils mounted on the top of the machine as shown in the view of the complete unit. All of the welding in the manufacture and assembly of the ice machine was done with "Stable-Arc" welders manufactured by The Lincoln Electric Company, Cleveland, Ohio. Credit for the ingenious design and construction of the new type automatic ice machine should be given to M. H. Ackerman, president of the Mansfield Ice Machine Company.

Merchandising a Welding Service

Sending of Letters Regarding Specific Uses of Welding to Carefully Selected Lists Brings Better Results Than General Letter

By Willis Parker

THAT a welding service may be merchandised just as readily as a more tangible product such as furniture, radios, automobiles or groceries is the experience of the Smith Welding and Engineering company of Denver, Colo., according to Luke E. Smith, president of the firm, and his associates, H. B. Klodt, who is vice-president, and Victor H. Pardee, secretary and shop manager.

The firm was only a year old at the time their merchandising methods were discussed, but the business was of such volume that the boys were busy all of the time and the condition of the treasury was indicative of the excellence of their advertising and selling program.

To go back a bit into history is necessary to better show why the firm came into existence and to uncover their vision of the future of the organization.

Luke E. Smith is, primarily, a road contractor. He has steam shovels, motor trucks, plows, graders and other heavy equipment subject to breakage at critical moments and at points far from welding shops and difficult to transport from the point of operation to the source of welding service. He experienced difficulty in obtaining the kind of welding service he desired. Other road builders were having the same difficulties, so he determined to organize a welding company that could and would give road builders the best of service—this for his own accommodation as well as for the accommodation of other contractors in the region. His associates, Messrs. Klodt and Pardee, were expert welders; a company was formed, equipment purchased and a definite program of business building undertaken.

One of the first moves was to standardize the service and the processes, then give the service a brand name, which is "LESCO". The name is formed, like many other trade names, from the initials of Mr. Smith and the addition of the abbreviation for company—L. E. Smith and Company. Then a trade mark incorporating, this name and the services the company gave and for which the brand name stood for, was constructed. The trade mark is circular with the name Lesco lettered in the area of a smaller circle in the center and the words "Welding," "Contracting" and "Engineering" lettered around the outside and confined between the circumferences of the concentric circles.

Next was the adoption of a business slogan—*"The Weld That Held."* Thus "LESCO" stands for "The Weld That Held."

The advantages of this arrangement is that the service is distinct and individual though the welding operations may be exactly like that of any other welder. The customer remembers the trade name—"Lesco"—when all else is forgotten. In discussing the weld with acquaintances he refers to it as a "Lesco" weld—not merely a "weld." He may have forgotten the firm name, but by consulting a business directory or the classified columns of the telephone directory he easily picks out the ad bearing that trade mark and ascertains the firm name, location and telephone number.

Almost coincident with the establishment of the shop, the firm sent out letters to all of the road builders in the region to announce the new organization and the facilities for taking care of their troubles. The response was gratifying.

And it is in the direct by mail advertising campaign, or methods, that the greatest sales effort is placed. Welding service may be applied to the rehabilitation and the salvaging of so many different products that it is difficult for the average person to recognize when he might save money by having an article welded and when he would be better off by buying new equipment. Generally speaking the public considers welding as a process confined entirely to the repair of automobiles and heavy machinery. A general letter on welding sent to all classes of people would not get the results that the welder would naturally expect because it would not bring to each recipient's mind the possibility of salvaging some certain article in his business.

For this reason, the letters sent out by the Smith company

Always Ready For a Long Distance or Rush Call.

are specific. There is no wasted effort. A letter sent out to mining companies deals solely with the firm's ability to weld mining machinery and equipment; one sent out to factories deals only with factory machinery; one sent to road builders deals with road building equipment; one to general contractors deals with the types of machinery they use in the construction of buildings.

To illustrate we will consider a letter sent out to apartment house owners who usually are always interested in savings which may be made in connection with the heating plants in their buildings. This letter, which was sent out October 3—just at the time of year when landlords should be inspecting the heating plants and getting them ready for winter—dove directly into the subject with the opening paragraph, which read:—

"On the account of the large amount of business which you handle, we know that you also have a large amount of repair work to be done on your steam heating and hot water plants. We realize that when one of these plants goes out of commission it means a lot to the owner to have repairs made in the shortest possible time. We are in a position to give you the quickest possible service."

The remainder of the letter deals with the practicability of repairing plants in place with electric arc or acetylene welding. Needless to say the letter should appeal in case the landlord is faced with the problem of replacing broken plumbing fittings.

However, it is quite possible that Mr. Landlord has nothing of this sort to be welded. There may be something else, and, in case there is, a reference to the printed listing down the left margin of the letterhead may remind him of it. This listing serves the dual purpose of merely listing the various kinds of work done and of enabling the firm to take one

specific item in the letter for an exposition of the practicability of welding that item and then mention other services without having to include this mention in the body of the letter. The thought is:—

"We are experts in welding THIS ITEM, but we also handle these other lines."

The telephone directory advertisement has been the source of much business where customers did not know of any certain welder, and consulted the directory to select, by chance, one to accomplish a repair job. Most of them admitted that they looked over the list and selected the firm whose ad appeared to be the most businesslike. The Smith company ad was the only one bearing a brand name for the service.

Like many other welding concerns, this one maintains a portable outfit and responds to out of town calls as well as city calls. The truck has on it a 200 ampere, gasoline driven electric generator and tanks for acetylene gas. It is out practically all of the time and has been as far as two hundred miles from the shop.

WELDED CAISSON RINGS USED IN THE CONSTRUCTION OF CHICAGO'S MERCHANDISE MART

The building of the Merchandise Mart, which when completed will be the largest building in the world, involves the excavation of 472 caissons down to hardpan. To reach that surface they had to dig down to about 70 feet below city datum. These caissons are circular in form and range from

Left—Old Style Rings of Strap Steel. Right—New Rings of Channel Iron With Flanges Welded On.

five feet to about ten feet in diameter. The lagging in the caissons is held in place by two kinds of steel rings which are made up in half circles and then bolted together to form the complete circle. The old type commonly used were made up of two heavy pieces of strap steel, four inches wide and a half inch thick, and of a proper length to be about eight inches longer than one-half the desired circumference. This strap was rolled to form a half circle and then about four inches of each end was bent in toward the center. Holes having been punched in these ends, the two semicircles were bolted together to form the complete ring.

The new type of caisson rings are assembled on the same principle, but are fabricated by arc welding and then tested for strength by hammering. They are made up of channel iron rolled to form a half circle with the flanges in. As may be seen in the above photographs the small pieces of steel plate punched for bolt holes are welded to each end of a bent channel iron. Then when two of these are placed with ends together they form the full circle, and serve their purpose of holding the lagging behind them against the sides of the caisson.

Joseph T. Ryerson & Son, Inc., is supplying the rings ready to install, and at the present date have delivered about 208 tons of them. Mr. Griffith, the well known engineer and contractor, who is putting through this job says that the advantages of these new rings lie in the fact that they are much lighter and thus easier to handle, and that because of the channel and welded construction they stay in shape despite the rough usage to which they are put.

CHICAGO SECTION DISCUSSES STEEL WELDING

The monthly meeting of the Chicago Section of the American Welding Society was held on Friday, November 2. The meeting began promptly at 7:30 with several reels of motion pictures showing how the raw rubber is obtained from the Goodyear plantations down in Sumatra. Following these pictures a very interesting technical talk on "Oxy-Acetylene Welding of Steel" was presented to us by Mr. L. M. Rasmussen of the Oxweld Acetylene Company. The talk covered the field of oxy-acetylene welding of steel in a very complete manner and much emphasis was placed on the importance of knowing the physical properties of the steel welded. Other factors stressed were the importance of the design of the weld, procedure control, and having capable workmen on the job. The talk included within it a thorough discussion of the testing of welds, and some of the latest developments in that field were explained along with a formula for computing the allowable working stresses for welds. Mr. Rasmussen concluded by saying that on the whole competent workmen well supervised will give good welds.

Following the talk there was quite a bit of discussion and Mr. Ernest Lunn of the Pullman Co. told of some of the developments along this same line which had been brought up at the national convention at Philadelphia. There was then some discussion of a more general nature which concluded the meeting.

PLUMLEY LEAVES G. P. A.

Mr. Stuart Plumley who has been Secretary of the Gas Products Association since January, 1927, has resigned this position to accept a new position in the organization of the Smith Welding Equipment Corporation, Minneapolis, effective November first. Mr. Plumley has been many years of active service iu the gas welding industry, having started in 1909 with the Linde Air Products Company at Buffalo, New York. He continued in the service of that company and later the Oxweld Acetylene Company until 1914, when he became identified with the Superior Oxygen Company at Pittsburgh. Two years later he joined the organization of the Davis-Bournonville Company and was associated with that company up to the time of its purchase by the Air Reduction Sales Company, and was in charge of apparatus for the later company in Chicago until 1923, when he was appointed editor of the Acetylene Journal, at the same time taking over the secretaryship of the American Welding Society, Chicago section. In January, 1927, he resigned his position with the Acetylene Journal and was made secretary of the Gas Products Association, which position he has held until the recent change. Mr. Plumley's friends in the Gas Products Association, together with the directors of the Chicago section of the American Welding Society, tendered him a farewell luncheon at the Palmer House, Chicago, on October 23rd. This time he was presented with a generous gift in behalf of the American Welding Society, as a reminder of his long period of faithful service as secretary.

TALKS TO CHICAGO STEAMFITTERS

Mr. J. I. Banash, consulting engineer for the International Acetylene Association, talked to the Master Steamfitters of the Chicago district at a luncheon held at the Bismarck Hotel, Wednesday, October 17th. The subject was "Industrial Pipe Welding from the Point of View of Its Economies and Probable Future Developments." This talk was well received and it is said that Mr. Banash may have an opportunity to present a paper on this subject at the next annual meeting of the National Association.

Arc Welding in Ship Construction

A Brief Record of the Progress Which Has Been Made With Welding for Construction and Repair in British Shipbuilding Circles

By E. D. Lacy*

ALTHOUGH electric arc welding is in a very different position from what it was a few years ago, progress is not so speedy as the exponents and advocates of this process would wish it; the reasons for its relatively slow progress in ship construction can be accounted for by the following—

(1) The conservatism of shipbuilders and constructors; ever since ships have been built of steel, ship constructors have got used to its present design, i. e., a riveted ship.

(2) The lack of skilled welders.

(3) The opposition of the trade unions.

During the war and since, the conservative prejudice of shipbuilders has been gradually breaking down and most naval architects now realize that welding can play a large part in the construction of at least small vessels.

More skilled welders are now coming forward than hitherto, and generally speaking, it has been found that a skilled workman, particularly a boilermaker or a blacksmith, who has necessarily obtained some knowledge of other welding processes should become an efficient arc welder in six weeks' time. Welders are being trained as rapidly as possible in all parts of the world, that is to say, as rapidly as the supply of good teachers will permit, but given an intelligent man and a good tuition, a year or two's practice at the work should convert pupil into teacher.

When welding was first introduced in England, much opposition was felt from the trade unions, who laid down all sorts of difficult rules and regulations which considerably handicapped this new industry at its birth. However, at the present time, trade unions are becoming more sympathetic towards welding. No doubt, in a few years, they will realize that, given their wholesale sympathy, welding will make for a greater general prosperity and they need have no fears of any wholesale reduction in employment in the ship-yards or elsewhere.

Materials are now being made which enable any class of alloy, both ferrous and non-ferrous to be satisfactorily welded and new developments are being made every day by such firms as Alloy Welding Processes, Ltd. In spite of the above mentioned disadvantages, progress if slow, is gradually being made, and as an industry, electric arc welding is still in its infancy.

Shipbuilders and ship-repairers are now beginning to realize that much time can be saved by welding in place of riveting, in fact, ship construction and repairs can now be carried out with greatest speed and efficiency by this means.

There is, undoubtedly, great scope in shipbuilding for the utilization of welding which has been found suitable for the building of smaller vessels and can now be extended to vessels of larger size, as experience is gained, and as the processes are perfected.

Not only for structural purposes, but for the building of boiler and deck and below deck machinery can this process be used, and it has now been proved beyond doubt that a welded joint is very much stronger than a riveted one.

It should be possible to do away with riveted joints altogether, and by welding you would have a homogeneous whole; the ideal ship would be built in one piece, welding having joined all parts into one.

In actual experience, it is hard to show achievements obtained by the use of arc welding in shipbuilding, because no testing machine could reproduce complete stresses endured by a ship in service.

The first all welded ship to be built in the country was a barge constructed at Richborough and welded by Royal Engineers. This barge was designed for cross channel service, and owing to having carried all kinds of war materials, suffered from very hard usage. The barge was 126 ft. long, 16 ft. 4 in. in breadth, and 7 ft. 6 in. in depth.

Up till 1924 she was in the service of the Port of Queenborough Development Co. Ltd., whose engineer, Mr. J. W. Bruce stated after his examination, "This barge has been thoroughly tested by me recently, and I find all strake welded laps and joints, frames, web frames, beams and half beams, and all welded parts in excellent condition. This barge, with others of the A.c. type has been subjected to very rough treatment and heavy war service during the busy war period at Richborough. She consequently shows definite signs of same, but nevertheless remains in excellent condition and quite tight when loaded. Up to the present it has not been necessary to have any work whatever done to the hull or deck. The vessel is in good seaworthy condition and I consider her much stronger then riveted barges."

The next all welded vessel to be built was the motor ship "Fullagar" whose dimensions were:—Length 150 ft., breadth 23 ft. 9 in., depth 15 ft. 6 in. It is interesting to record that this ship was built to the classification of Lloyds Register, and may be said to have arisen out of a series of experiments on welding, carried out by Lloyds Register of Shipping. The vessel was built by Messrs. Cammell Laird & Co., Ltd., Birkenhead.

Quoting from a paper read by Mr. A. T. Wall before the British Institution for Mechanical Engineers in 1922, "This ship has been commissioned for about 18 months, the welding employed for her construction has been proved highly satisfactory. She has carried several cargoes of steel plating and similar material, and has encountered heavy seas without showing signs of failure of any welded joints."

"At one time, in a collision, she received an indentation in her side without starting any welding. Lloyds Register of Shipping recently examined this ship and reported that there were no signs of weakness, even at the break at the Port of deck, which easily happens to riveted vessels of this class."

Since the war, several all welded ships have been designed, one by Sir J. W. Isherwood who designed a modified longtitudinal frame ship, the modifications consisting of the use of arc welding for the making of practically all joints, the design being in accordance with Lloyds Register of Shipping Rules for Electric Welded vessels. The design was such that no overhead welding was required for strength members; by using wide plating, large portions of the frame could be welded to plates in the shop.

This Isherwood design which was prepared with the cooperation of Sir W. S. Abell, Chief Surveyor of Lloyds Register of Shipping is such that any ordinary shipyard could readily have handled.

Another design was by Major James Caldwell, now chairman of Alloy Welding Processes Ltd., who prepared a design for an all electric welded barge, using a conventional transverse frame ship design with certain modifications and details in the construction. This design was based on the

*Alloy Welding Processes, Ltd., London.

experience gained from the building at Richborough of the cross channel barge described above.

Major Caldwell stated that the principles governing the substitution of arc welding for riveting in the construction of a ship were as follows—

(1) Obtaining equivalent strength.
(2) Minimum of overhead welding.
(3) Ease of repair.

In his "Notes on Welding Systems," Major Caldwell gives some interesting details regarding the comparative cost of Electric Welded and riveted barges. "In the labour, 245 man-hours were saved in the construction of the welded barge, more than 1,000 lbs. of metal was saved by the substitution of welding for riveting, even greater economy will result when the design is modified to suit Electric Welded ship construction. The total cost of welding was £301 comprising electrodes of £178, electric current £61 and labour £62. The cost of assembling similar barges built in the same yard by the ordinary method of construction, including riveting caulking, and drilling, was £389, 8. 0. whilst in another yard where ten barges were built, the average cost was £453, 8. 0."

In a report from one of the Admiralty Dockyards where the electric welding process has been extensively employed, it was claimed that electric welding, if applied instead of riveting, would reduce the cost of labour on the ship by 75 per cent.

Welding has now been used for some years for ship repair and its use for this purpose is becoming commoner day by day, in fact, it is very rare that any metal part cannot be repaired so that it is in as good a condition as it was before the breakage occurred. In many cases the part which was originally on the weak side can be reinforced during the welding operation. Installation of Electric Arc Welding Plants and Equipment are now found in all shipyards and Admiralty Dockyards; regarding the latter, it is interesting to note that a plant has been supplied for the new floating dock destined for Singapore. The complete equipment was supplied by Alloy Welding Processes, Ltd., London.

The machine in question consisted of a central motor driving two "A.W.P." Generators of their now well-known self-stabilizing, drooping characteristic type. The motor and generator together with all necessary control gear were mounted on a substantial bedplate having small wheels, and the whole forms a self-contained portable unit that can be readily moved from one position to another on the floating dock. The machines have had to comply with the special Admiralty rating, and we learn that they passed their tests satisfactorily.

The advantages of electric arc welding in ship construction are now so great that it should be possible in the not too distant future to construct not only all-welded tramp steamers and cargo ships of considerable tonnage, but great liners and even warships.

PROPOSED REVISION OF ALUMINUM WELDING ROD SPECIFICATIONS

The Technical Committee on Metals of the Federal Specifications Board has recommended a revision of U. S. government Specification for Rods, Welding, Non-Ferrous, for gas Welding, F. S. B. Specification No. 269.

It is proposed to change the chemical requirements of Aluminum Alloy, Type E, under Detail Requirements, Section IV, Page 2 of the specification to read as follows:

Aluminum Alloy
Type E.

Aluminum	minimum	92.5 per cent
Silicon		4.5-6.0 per cent
Iron	maximum	1.0 per cent
Copper	maximum	0.6 per cent
Zinc	maximum	0.2 per cent
Manganese	maximum	0.2 per cent
Magnesium	maximum	trace

The present chemical composition of Aluminum Alloy reads as follows:

Aluminum Alloy
Type E.

Aluminum	91.0	—93.0 Per Cent
Copper	7.0	— 9.0 Per Cent
Iron	Maximum—	1.5 Per Cent
Other elements	Maximum—	1.0 Per Cent

The Federal Specifications Board will be glad to receive any comments or suggestions as to changes which may be thought to be desirable in the specification.

Such comments or criticisms will have to be received by the board not later than December 15, 1928, and should be addressed to Federal Specifications Board, Washington, D. C.

CENTRAL WELDING SHOP AN ASSET TO ANY PLANT

Today, modern plants have come to rely upon the oxy-acetylene process in a measure undreamed of a few years ago. Uses of welding can readily be classified under two headings, that of manufacture, and that of maintenance and repair. Whether a plant is concerned with producing a product where metal plays an important part, or whether it finds use for the oxy-acetylene process merely as a means of maintenance and repair, most progressive factory managers are agreed that the oxy-acetylene welding process will save them money or will increase their production.

The average new user of welding, or sometimes even the experienced user of an oxy-acetylene outfit is not familiar enough with the potentialities of the oxy-acetylene process to realize fully all the uses to which it can be put. A sheet metal working company might purchase oxwelding equipment to weld a particular lot of tanks and fail to realize, when a punch frame cracks under overload, that they have already on hand a means of speedy and economical repair. Again, a manufacturing plant might buy an outfit solely for repair work, never realizing that their welders could take an important place in direct production by oxwelding some part of their metal product. Or, a company might use its outfits for both repair and production work without knowing that they could also be used to install a shop or yard pipe line, or to cut up scrap.

Conditions of this sort are not conducive to true economy because all available resources are not being utilized. But on the other hand, it probably would not pay to employ a man solely to look for places to use the cutting and welding blowpipes. The best procedure is to let new applications come to light naturally.

This is often done quite readily by establishing a central welding department. It is not necessary that all oxy-acetylene operations be carried on in a special building, but rather that they be organized and assigned a definite headquarters in a certain shop. If the machine shop wants a foot treadle repaired let them have a place to take it. Or, if the men tearing down old equipment want some steel work cut away, let them have a definite place where they can locate a "cutter," with the necessary equipment.

A true central welding shop accomplishes several things: Operators know where to find apparatus; shop foremen know where to go to have cutting and welding jobs done; it is possible to have a welding foreman of more than ordinary ability; and executives have a means of keeping track of welding costs.

When one considers the number and diversity of jobs which can be done by such a department it can readily be appreciated that the shop need never be without work of some kind. If there are no production jobs the operators can always reduce the plant's scrap pile either by reclaiming material or by cutting up worthless junk to handling size. Thus managed, a central welding shop will prove a real boon to any plant. It can be a self-contained organization, always busy and always assisting in cutting down operating expenses.

UNUSUAL PIPE WELDING IN NAVAL CONSTRUCTION

By F. G. Crisp*

The accompanying photographs show some unusual and interesting piping assemblies made by welding. This piping forms a part of the fuel oil filling and suction piping system of the Nevada, which is now being modernized at the Norfolk Navy Yard. The use of many small tanks for oil involves a very complicated piping system involving many sections of pipe and branches to the various tanks, manifolds and valves. Prior to the use of welding all flanges were rolled and branches fitted by means of cast tees, elbows and other fittings. What saving in weight and cost is affected by the construction now used can be judged by the number of fittings which would be required in the case of the sections shown in the photographs. Not only is the use of heavy and expensive cast steel fittings eliminated, but no machine shop work is required and the cost of making up joints, which may stay tight, is entirely eliminated. The final cost of fabricating these sections is approximately one-half that of work done in accordance with previous method of fittings, etc., the work of installation aboard ship is reduced materially, the weight is reduced by about 25 per cent, and the systems are tight so far as any welded part is concerned. In case of damage to piping after installation, replacement is affected by cutting out the damaged section and welding in a new section.

A brief description is given in regard to the processes of making these branch connections should these processes not be familiar to any one interested. The location of branch is marked on the main pipe and a hole is cut in this loaction slightly smaller than the diameter of the branch. The metal of the pipe around the edge of this opening is heated by means of torch and flanged up. It is then ground reasonably smooth and beveled for welding. The branch pipe is similarly prepared for welding and is then tack-welded in place and then welded permanently. Electric welding is used almost exclusively.

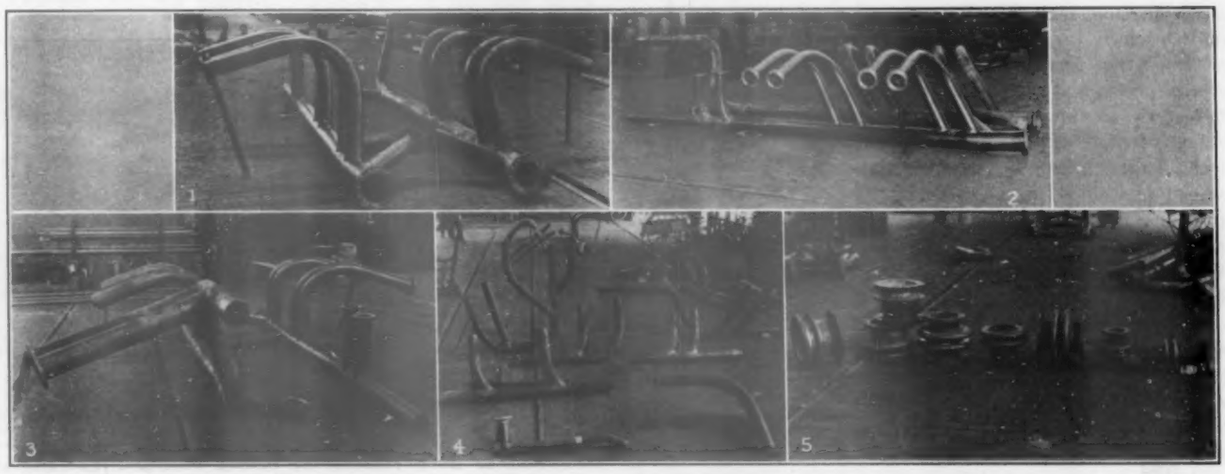
Fuel oil piping systems constructed in accordance with the foregoing have been installed in several ships and have given perfectly satisfactory service. Figures 1 to 4 show the assembly before and after welding.

Complete success has been obtained by the use of a welded corrugated expansion joint in fuel oil systems. The joint is shown in Figure 5. It is made up of sections of bellows assembled by welding together the halves which are formed under dies. The bellows are then assembled by welding, one to three sections being used as designed to care for the expansion. The pipe ends are then welded and flanges fitted by welding. These expansion joints are tested by subjecting them to an internal hydraulic pressure of 100 pounds and while under this pressure alternately extending and compressing ¾ of an inch 100 times. This type of expansion joint has been used extensively in fuel oil systems and has never been known to fail in service. It can be made absolutely tight.

Figure 5 shows also a type of bulkhead fitting made up by welding, which consists of a section of piping with mild steel flanges cut by means of an acetylene torch from scrap plate. The final cost of this fitting is about one-half that of a cast steel fitting of the same size and weighs less due to the lesser weight of the pipe section.

The welding of pipe and the manufacture of all-welded pipe fittings has been the practice at the Norfolk Navy Yard for many years and such pipe and fittings were used in the yard systems several years in advance of their use being permitted in ship installations by the navy department. There are installed in the Norfolk yard approximately ten miles of piping of all sizes and pressure up to 100 pounds, assembled in this manner, which has given entirely satisfactory service.

Strength welding is particularly well adapted to piping because the strength of the weld can be tested under actual working conditions prior to installation and because of the great decrease of cost both for original installation and upkeep.



Figures 1 to 4 Show Various Assemblies Made Up Entirely by Welding. Figure 5 Shows the Type of Welded Joint Used on the Battleship "Nevada."

Shop Superintendent, Norfolk Navy Yard.

P. SAMUEL RIGNEY

It is with great sorrow that we record the death of P. Samuel Rigney, senior vice-president of the Compressed Gas Manufacturers' Association. His sudden death was due to a stroke during the evening of October 23, 1928. At the time of his death Mr. Rigney was secretary of the Roessler & Hasslacher Chemical Co. Born in Orange County, New York, December 23, 1872; married Elizabeth V. Schaad, November 26, 1902; educated at district school, village high school; studied law, Newburg, N. Y. Mr. Rigney entered the chemical industry May 1, 1918, and progressed rapidly. His sterling character and business ability were recognized by all who had the privilege of knowing him. He was secretary and director of the Niagara Electro Chemical Co., Inc,; assistant treasurer and director, Niacot Chemical Corporation; secretary, Roessler & Hasslacher Platinum Works, Inc.; senior vice-president and member of the executive board, Compressed Gas Manufacturers' Association, Inc.; vice-president and governor, Synthetic Organic Chemical Manufacturers' Association of the United States; treasurer and director, Chlorine Institute, Inc.; staff of 203rd Regiment, New York Volunteer Infantry, Spanish-American War; Past Adjutant General, United Spanish War Veterans. Clubs: Orange County Society, Siwanoy Country Club, and Chemists' Club.

WELDED METAL RAILROAD TIES USED ON SWITCHES

Another stimulus to the consideration, by railroads, of the substitution of metal for wooden railroad ties is expected as a result of the application of welded metal ties to switches and cross-overs by the Delaware & Hudson Railroad. This company has recently completed the rearrangement of the spur which connects its main freight line with the General Electric plant at Schenectady, and all the old wooden ties were replaced by the metal variety.

The feasibility of metal ties was suggested by William Dalton of the General Electric Company, early in 1927, and Mr. Dalton announced at that time that his company had designed automatic welding machinery which could produce metal ties at a lower overall cost than that of the wooden type. The Delaware & Hudson Railroad pioneered in the new field by installing machinery at its Colonie, N. Y., shops for welding metal ties, and by installing a section of track in its freight yards at that point utilizing welded metal ties fabricated from worn rails.

Until recently, however, such ties had been used on straight track only. The installation at the General Electric plant at Schenectady includes all types of track which are commonly used in railroad service, with the exception of track involving the signaling function on which developmental work is now in progress. Not only were the switches and cross-overs mounted on metal ties, but the switch stands themselves were mounted on extra long metal ties. By a simple arrangement the base on which a switch stand is fastened is welded to the ties resulting in a firmly fastened stand, but allowing its easy removal for replacement or repair if necessary.

For this special construction, scrap rails, cut to the proper lengths, were delivered on the spot and there welded by hand and installed under the track. The railroad crew foreman in charge of the installation claimed that not only was the work simplified with the metal tie, but that he could do a much better job with more permanent, beneficial results.

A particularly advantageous consideration, it was found, developed in connection with the installation of the cross-overs. Where one track left another at a switch, metal ties of greater length were used, a single tie being common to both sets of track for quite a distance from the switch. It is believed by Delaware & Hudson experts that this affords quite an important saving over the cost covering a similar practice using wooden ties. The value of using single ties common to both sets of track in such applications lies in the stabilizing effect at a point subjected to particularly heavy stresses, thus tending to provide a firm, strong switch with no tendency to weave or tilt out of position.

The Delaware & Hudson's metal tie fabricating shop at Colonie, N. Y., is built around an automatic arc welding machine designed and built by the General Electric Company. Its present output is about 20,000 ties per year which is entirely covered by requisitions from the various operating divisions. Metal ties are now considered standard by the Delaware & Hudson Railroad for everything except signal track.

PURDUE WELDING CONFERENCE NEXT MONTH

Purdue University announces its Fourth Annual Conference on Welding to be held at Lafayette, Indiana, on December 12, 13, 14, 1928, under the direction of the Engineering Extension Department, and the Department of Practical Mechanics, with the School of Chemical Engineering and the Manufacturers of Welding Equipment, cooperating.

This educational conference will be devoted to the applications of electric, oxy-acetylene and thermit welding to manufacturing and repair operations.

Conferences held during the past three years have attracted a large number of plant officials, foremen, and others interested in welding operations, from the industries of Indiana and neighboring states.

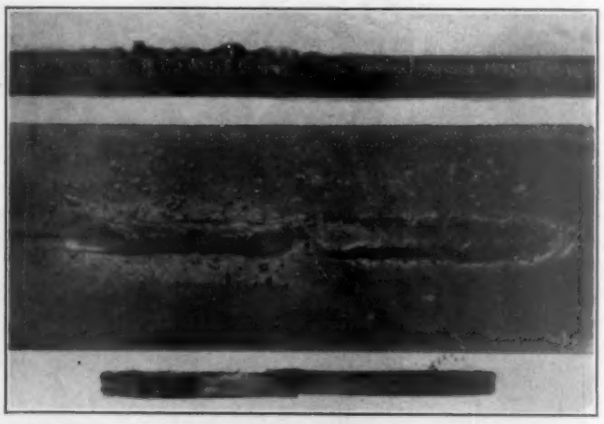
Provisions will be made for exhibits and demonstrations.

Programs will be ready for distribution about December 1st and may be obtained by addressing The Engineering Extension Department, Purdue University, Lafayette, Indiana.

NEW WELDING ROD DEVELOPED TO INCREASE SPEED OF WELDING

Announcement comes from the Research Laboratories of The Lincoln Electric Company, Cleveland, Ohio, of the perfection of their most recent development, a welding electrode which will be known as "Fleet-Weld." As a result of much experimentation and research a new welding rod has been perfected which is said to produce a dense weld of greater ductility at greatly increased welding speeds. It has been found from recently conducted tests, that in general, the speed of welding has been doubled or trebled by use of the new rod.

The wide use of high speed electrodes has been retarded in the past due to the porosity obtained when the higher currents necessary for fast welding are used. It is claimed that the newly developed rod because of the highly specialized processes of its manufacture has overcome this difficulty. In the photographic illustration, Figue 1, a graphic comparison is made of the porosity of beads laid down with the common type of wire and with the new electrode.



Comparison of Welds Produced by Various Electrodes, Including the "Fleet-Weld."

An incidental advantage which the new electrode offers, is the smooth finish of its bead. This in part is caused by the higher speed of travel allowed by the new electrode and also is in part inherent in the composition of the rod. The difference in appearance of the bead of ordinary wire used at higher currents and of the new electrode on a butt joint of ½-inch plate may be judged by Figure 2. The light area around the beads indicates the extent of oxidation. The bubbles of metal on the plates were caused by the spatter of molten metal when the ordinary wire was used. The absence of a crater in the new electrode bead is indication of its smooth flow when in a molten state.

Greater ductility of the bead as well as deeper penetration are two of the requisites of better welding which are claimed for the newly developed high speed wire. Proof of the depth of penetration when the new welding rod is used is evidenced in the photograph of a section through a welded joint, Figure 3.

The electrode itself is an extruded wire that permits high speed welding without loss of denseness and ductility to the weld metal. While "Fleet-Weld" electrode has so far been a laboratory product, it is expected to be commercially manufactured and placed on the market in the near future.

PLANT FOR SMALL VOLUME CHROMIUM PLATING

The Chromium Engineering Corporation with offices at 246 Fifth Ave., New York City, have recently added a new division to their business. Previously this corporation only handled the supervision and installation of Chromium Plating Plants for manufacturers and job shops. Now they will also maintain and operate a large plant of their own for the convenience of the manufacturers who have Chromium Plating work, but not in sufficient quantity to warrant operating their own plating plant.

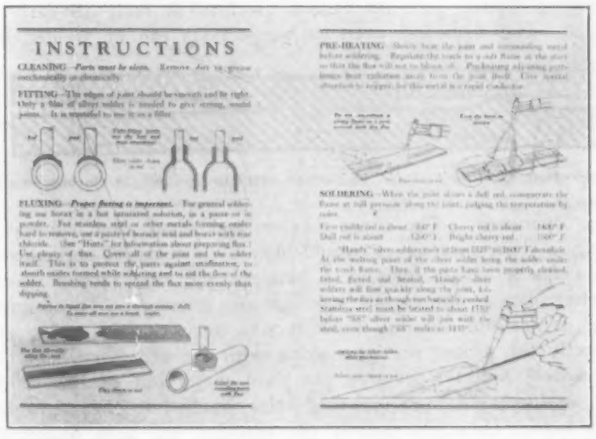
ACME GAS PLANTS ADDED TO AIRCO CHAIN

The Acme Oxy-Acetylene Company has consolidated with the Air Reduction Company, thereby making the Air Reduction Company the largest producers of Oxygen, Acetylene, Hydrogen and rare gases in the Chicago district, with two Oxygen and two Acetylene plants, all of which will be continued and enlarged as demand requires.

E. D. Findlay, President of the Acme Oxy-Acetylene Company, is being retained by the Air Reduction Company in an advisory capacity; and the entire staff of officers and employees will continue with the Air Reduction Company.

TWO BOOKLETS ON SILVER SOLDER

It has long been known that silver in combination with certain other metals produces a comparatively easy flowing solder which has superior strength and resistance to vibration in shock. The firm of Handy & Harman, New York City, has in fact been supplying silver solder to a few industries


INSTRUCTIONS

CLEANING—*Parts must be clean.* Remove dirt or grease mechanically or chemically.

FITTING—The edges of joint should be smooth and fit right. Only a film of silver solder is needed to give strong, sealed joints. It is wasteful to use it as a filler.

FLUXING—*Proper fluxing is important.* For general soldering use borax in a hot saturated solution, or a paste or in powder. For stainless steel or other metals forming oxides hard to remove, use a paste of boracic acid and borax with zinc chloride. (See "Handy" for information about preparing flux.) Use plenty of flux. Cover all of the joint and the solder itself. This is to protect the parts against oxidization, to absorb oxides formed while soldering and to aid the flow of the solder. Brushing tends to spread the flux more evenly than dipping.

PRE-HEATING—Slowly heat the joint and surrounding metal before soldering. Regulate the heat so it will flow at the point so that the flux will not be burned off. Preheating also may prevent heat radiation away from the joint itself. Iron wedges attached to support, but this metal is a rapid conductor.

SOLDERING—When the joint shows a dull red, temperature the frame at full pressure along the joint, judging the temperature by color.

Faint cherry red is about 1247° F. Cherry red is about 1472° F. Dull red is about 1247° F. Bright cherry red ... 1607° F.

"Handy" silver solders melt at from 1125° to 1610° Fahrenheit. At the melting point of the silver solder being the solder under the touch flame. Then, if the parts have been properly cleaned, fitted, fluxed and heated, "Handy" silver solders will flow quickly along the joint, following the flux as though not basically cooked. Stainless steel must be heated to about 1750° before "56" silver solder will join with the steel, even though "45" melts at 1410°.

A Couple of Pages from Handy and Harman's "Handy Book of Silver Solder."

for half a century. However, it has not always been appreciated that the characteristics of silver solder were adaptable to almost every kind of metal manufacture.

In recent years progressive manufacturers have been less content to use old methods and have established research laboratories to devise new, better and more efficient ways of producing their goods. In these laboratories men of science have quickly found the natural advantages of such metal combinations as silver solder. With the first signs of growing interest Handy & Harman started a thorough study of all known compositions, at the same time developing new ones and making tests under all kinds of conditions.

The research work which extended over a number of years resulted in adopting twelve standard compositions of silver solder which vary in melting points and other characteristics so that among the twelve there are one or two which will meet any of the usual conditions.

A brief review of this research is presented in a booklet called "The Handy Book of Silver Solder," which is being offered by the above firm. In it the standard solders are described and separately in a bulletin the best methods of using silver solder are described. The instruction bulletin is very complete in detail and has some valuable illustrations, as well as working information for the men who use the solder.

NEW ELECTRODE HOLDER ANNOUNCED

The Fusion Welding Corporation of Chicago recently issued an illustrated leaflet describing their new Model A Electrode Holder. One of the principal advantages claimed for this new product is that the act of inserting the electrode scrapes off all dirt and insulating substances, insuring perfect contact and thus preventing overheating. Other advantages claimed for it are that it is simple in construction with no springs or thumb screws; that it is made of a special copper alloy which resists arcing; that it is light weight, properly balanced, and easy to hold; and that the electrode is held firmly in any position.

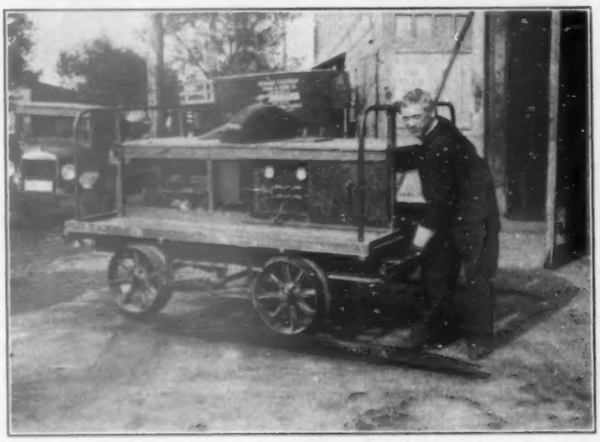
MUELLER BRASS DEVELOPS BEARING METAL

A pamphlet being sent out by the Mueller Brass Co. of Port Huron, Michigan, tells of the development of an alloy which they call Mueller "600" Bearing Metal. It is claimed that this is a true forgeable bearing alloy that can be used where cast phosphor bronze, cast gun metal, or cast nickle bronze are now being used for bearing purposes or for strength.

DUALARC COMBINATION MOTOR AND ENGINE DRIVE ADAPTED FOR RAILROAD WORK.

The welding car illustrated was described in the October issue, including mention of the turn table, operation of which is clearly shown in the photograph. It can be quickly jacked up and the car removed from the track in any direction with a minimum of delay.

The welder is the combination gas and electric drive



Dualarc Generator Mounted as Self-Propelling Unit for Railway Work, with Portable Turntable.

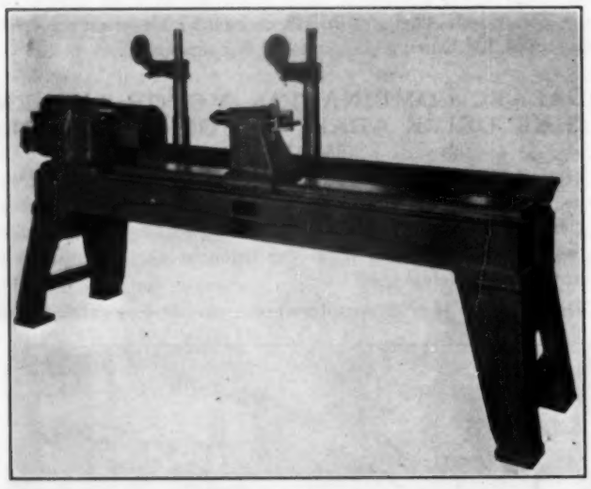
Dualarc generator. The manufacturers state that this welder maintains the same welding characteristics whether operated as an engine-driven set, in which the speed holds constant, or as a motor-driven set, in which the speed varies with variations in the load.

NEW ARC WELDING MACHINE

One of the interesting features of the General Electric Company exhibit at the Philadelphia Exposition was the demonstration of the Bowlus welding machine equipped with General Electric automatic arc welding head. This machine was developed with the plan in mind of combining a number of standard units into a machine that would be applicable to a wide range of welding operations. A number of years of

experience in the development of automatic arc welding applications has culminated in this machine, which has independent rotary and transfers movements. The live spindle is driven by an independent motor arranged with dynamic brake, controlled by the standard electric automatic arc control panel. A special patented registering and limit switch device stops the machine at the end of one revolution or any desired cycle, while the operator can busy himself with other operations. In many cases one operator handles two machines. The quick acting toggle-operated tail stock, moveable on splash-proof ways, is adjustable for any length up to 60 inches between centers. The welding head spare is mounted on a motor driven gear box with 2 ranges of traverse speed with precision adjustment by field rheostat control and dynamic braking control in conjunction likewise with the General Electric control panel. Either one or both movements can be used together or separately at the will of the operator.

In one application of this machine 3 and in another 4 welding heads are mounted for 3 or 4 welds concurrently on the same piece of work. In another three welding heads are used to weld four forgings to a tube in which six welds are applied to each piece in two operations. For such operations as building up armature shafts, or building a shoulder on



Bowlus Arc Welding Machine.

any cylindrical piece, both the rotary and traverse movement would be used, and the patented one revolution stop would be left out of operation. The automatic register and limit switch in one case stops the machine at the end of one revolution and in the other when the weld is carried only through an angle of about 120°. In case the machine is desired adapted to lay a weld on a straight line or a long and approximately straight contour a fixture can be mounted on the bed casting for clamping the work, the gear box and tail stock can be left off and a solid substantial machine is available on short notice for a variety of operations.

Particular pains have been taken to protect machined surfaces from splash and undue wear. There are available several combinations of sizes and adaptations of this general type as illustrated. The machine is made by C. A. Bowlus, 808 Bates Street, Birmingham, Michigan.

CHASE BRASS TO BUILD CLEVELAND MILL

The Chase Brass and Copper Company of Waterbury, Conn. has selected Cleveland for its midwest location, in which to build a new brass and copper plant. The announcement was made October 25th by the Industrial Development Committee of the Cleveland Chamber of Commerce, of which Mr. Randolph Eide is chairman.

The Chase Brass and Copper Company is one of the largest brass and copper companies in the world. It is the manufacturer of the well known Alpha Brass pipe as well as sheet, rod, wire, tubing and other brass and copper products.

Officials of the company have spent much time in Cleveland in the last few weeks, working with the Industrial Development Committee in finding land suitable for the new brass and copper mill.

SHAWINIGAN CHEMICALS ADDING TO PLANT AND EQUIPMENT

An extensive program of expansion has been undertaken by Shawinigan Chemicals, Ltd., at Shawinigan Falls, P. Q. This includes the erection of a rotary lime-burning plant, consisting of two rotary lime-kilns, equipped with pulverized coal-burning equipment, waste heat boilers, etc. The total expenditures in this connection will total about $300,000.

New equipment, costing approximately about $150,000, is to be installed at the quarry of this company, at Bedford, P. Q., including new crusher, screens, elevators, etc., so that 1,000 tons of crushed limestone will be available for the kilns at Shawinigan.

PERFECT WELDS BY THE MILLION

One of the most interesting examples of uniform large scale welding operations which has been published in recent months is being featured by the Federal Machine & Welder Company of Warren, Ohio, who perfected equipment for welding automobile bumpers by the projection process. The accompanying sketch indicates the shape of the pieces welded and the position of the projection. Quite an interesting welding problem is presented here because it is a case of welding quarter-inch .40 carbon steel to $\frac{5}{16}$ inch .18 carbon steel. Two four and even six projections can be welded in

Projection Welding ¼-inch .40 Carbon Steel to $\frac{5}{16}$-inch .18 Carbon Steel.

one operation. There are twelve welds on each bumper. Only a short time ago it would have been declared impossible to make a satisfactory weld between the low carbon steel gusset plate to the carbon steel bumper members. In designing a machine for this work it was necessary to arrive at exactly the proper pressure along with the necessary heat to overcome fluidity, pressing the fluid metal out of the weld by an increased high pressure being applied to the movable gib head. How successfully the machine has been designed to overcome all the difficulties incident to a welding operation of this type may be judged from the fact that a million bumpers were produced without showing any defects. In other words it is a record of about 12,000,000 uniformly satisfactory welds.

VICTOR ANNOUNCES NEW HARD FACING METALS

The Victor Oxy-Acetylene Equipment Company of San Francisco, California, advises that an arrangement has been perfected with the General Alloys Company of San Francisco, California, to market nationally the latest development of abrasion resistant metal "Cristite". "Cristite" is a result of over three years of experimentation and laboratory and field test of the General Alloys Company. By a new patented process, permitting the alloying of metals never before combined, a new metal has been compounded, free of cobalt, which is said to be of maximum hardness, cohesiveness, toughness and attrition resisting. "Cristite" is produced in several series, the most prominent ones being No. 1, No. 2 and No. 3. "Cristite" Series No. 1 shows an average scleroscope hardness of 92.8 in casting and 101.17 after application.

"Cristite" and "Dymon-x," a new diamond substitute, will

be introduced and marketed nationally. Literature is now available and should prove of great interest to the oil industry, railroads, aeroplane manufacturers and all other industries requiring hard surfacing materials to resist attrition. "Dymon-x" is particularly interesting, because it not only meets the specific requirements of a diamond substitute, but can be applied with the oxy-acetylene torch.

MILBURN COMPANY ANNOUNCES NEW CARBIDE LIGHT

The Alexander Milburn Company of Baltimore announces a new kind of carbide light which will especially operate with either lump carbide or carbic cakes. This addition to the Milburn line is to provide a light or welding generator, with extra gas storage space and which does not restrict the user to any particular kind of carbide.

The center of the carbide container is a cylinder which holds the carbic cakes and which is equipped with the proper facilities for taking care of the sludge. The outside of this container is filled with conical pockets for the reception of ordinary carbide.

In designing the new lights, the same features which characterize the standard Milburn Lights have been retained, such as the fact that the Milburn Light cannot be overcharged; it can be recharged without changing the water; has the automatic burner cleaner which cleans the burner while the light is burning; has low operating cost (only 3⅓c per hour for 8,000 candlepower, using ordinary carbide).

This dual fuel principle is incorporated in single lights of 8,000 and 12,000 candlepower and in the duplex light of 16,000 candlepower. This same principle will be incorporated in lights of other capacities on order.

News of the Welding Trade

The Chicago office of the Gibb Welding Machines Company, Bay City, Michigan, has recently moved from 35 E. Wacker Drive to new and larger quarters at 180 N. Michigan Avenue. Mr. C. O. Watson is in charge as District Manager.

In the November issue of Class and Industrial Marketing is an interesting article by Mr. T. C. Fetherston of the Linde Air Products Company describing how that company makes use of the service argument in an elaborate advertising campaign in industrial magazines.

The welding department of the Opportunity School of Denver, Colorado, which is under the direction of Mr. A. G. Odell, was featured prominently in a long and profusely illustrated story regarding the Opportunity School, which was printed in a recent issue of the Rocky Mountain News.

The Portland Oxygen and Hydrogen Company, Portland, Oregon, purchased the assets and property of the Portland Welders' Supply Company, effective November 1st, 1928. Both companies have been controlled by the same stockholders and management since their organization. The welding supply business will be carried on as heretofore at 113 N. Third Street, Portland. As a result of the consolidation the oxygen company is now in a position to supply everything for gas and electric welding and cutting.

An explanation of the theory and technique in cutting cast iron was the subject of the regular monthly meeting of the Victorian Institute of Welding Engineers held at Melbourne, Australia, September 19th.

Mr. S. W. Perry of Monmouth, Illinois, who formerly represented the DeVilbiss Company of Toledo, has joined the sales organization of The Alexander Milburn Company of Baltimore to especially travel the Middle Western territory. Mr. Perry has long been identified with the Paint Spray, Automotive, Welding and Cutting, Portable Light and Engineering Equipment fields.

Fred Ward & Sons, 170-174 First Street, San Francisco, California, have placed in stock a complete assortment of Seaco oxy-acetylene and arc welding rods, according to announcement received from Stulz-Sickles Company, Newark, N. J., and can make immediate deliveries from warehouse stock in San Francisco.

The office of the Stoody Company, Whittier, California, is making preparations to move into a new wing of their office building, which is now rapidly nearing completion. On account of increase in the force additional office facilities are required for the sales force, purchasing department and the general superintendent's office.

Mr. W. W. Roach, formerly associated with the American Brass Company as manager of the Sales Promotion Department in Buffalo, New York branch, has recently joined the home office of the Mueller Brass Company, Port Huron, Michigan, as assistant sales manager of the Mill Products Division. Mr. Roach has had many years' experience in the plumbing, building and architectural fields and has been with the American Brass Company for ten years. Previous to that he was associated with Dodge Brothers in the Manufacturing Departments.

On October 15th the Bettendorf Oxygen-Hydrogen Company, Bettendorf, Iowa, merged with the Air Reduction Sales Company of New York. Mr. A. J. Russell, manager of the Bettendorf Company, continues in charge of the Bettendorf plant.

The Chicago Steel and Wire Company has just opened a new branch office in Philadelphia at 1528 Vine Street. This office will be in charge of Mr. J. P. Morrissey and will carry a complete stock of Weldite welding rods and a representative assortment of Fuzon arc welders, as well as a suitable stock of welding supplies.

A new Prest-O-Lite gas plant located at 3155—27th Ave. N., Birmingham, Ala., commenced operations October 16, 1928. This plant will supply the local demand for dissolved acetylene used in oxy-acetylene welding and cutting. With this addition, the Prest-O-Lite chain now numbers 34 acetylene producing plants situated in industrial centers throughout the country. Mr. A. J. Topham is plant superintendent, and Mr. G. A. Andrews, whose headquarters are at the same plant, is district superintendent.

The Portland Welders' Supply Company has recently been appointed exclusive distributors for the Chicago Steel & Wire Company for the State of Oregon, for both welding rods and arc welding equipment. A complete stock of welding rods will be carried and arc welding machines will be on display.

Announcement has been received that the Fourth Mid-Western Engineering and Power Exposition will be held at the Coliseum, Chicago, February 12th to 16th, 1929. Power Week in Chicago is an outstanding event for industrial managers of the district and it is of interest to the welding industry not only on account of the exhibits of welding equipment and processes but also because of the growing number of exhibits of equipment assembled by one or more of the welding processes.

A new Prest-O-Lite gas plant, located at 3155 27th Avenue, N. Birmingham, Ala., commenced operations October 16, 1928. This plant will supply the local demand for dissolved acetylene used in oxy-acetylene welding and cutting. With this addition, the Prest-O-Lite chain now numbers 34 acetylene producing plants situated in industrial centers thorughout the country. Mr. A. J. Topham is plant superintendent and Mr. G. A. Andrews, whose headquarters are at the same plant, is district superintendent.

Mr. John Lucas of the Western Welding and Machinery Company, was a visitor in Chicago, October 23rd. Mr. Lucas has been in Europe since the first of May and was on his way back to Los Angeles. He has visited the principal countries in Europe and made a close study of welding developments.

Mr. S. W. Perry of Monmouth, Illinois, who formerly represented the DeVilbiss Company of Toledo, has joined the sales organization of The Alexander Milburn Company of Baltimore to travel the Middle Western territory. Mr. Perry has long been identified with the Paint Spray, Automotive, Welding and Cutting, Portable Light and Engineering Equipment fields.

At its recent annual meeting the American Society of Safety Engineers elected Mr. J. I. Banash, Chicago, Chairman for the ensuing year. Mr. Banash is consulting engineer for the International Acetylene Association and has been prominent in activities of this association for a number of years. He has also been active in safety work for a long time.

At a recent meeting of the Board of Directors of the American Welding Society, Chicago section, Mr. M. S. Hendricks, managing editor of the Acetylene Journal, was elected Secretary of the section. Mr. Stuart Plumley, who has been Secretary of the Chicago section for several years, has been obliged to resign this position on account of the fact that he is leaving Chicago to accept a new position with the Smith Welding Equipment Corporation in Minneapolis, Minnesota.

Mr. H. W. McClintock, formerly associated with Pittsburgh Testing Laboratories, Pittsburgh, and with Colby, Christie and Schofield, Philadelphia, has assumed position with Charles L. Gulick, New York City, as chief inspector in change of cylinder testing bureau. Mr. Gulick, it is learned, intends to supply the industry with a cylinder testing service. Mr. McClintock, possessing years of practical cylinder testing experience with leading cylinder manufacturers, is ideally equipped for this work.

A new acetylene plant at East Avenue and Short Street, South Charleston, W. Va., bringing the total number of Prest-O-Lite plants throughout the country up to 35, started producing on October 29th. Dissolved acetylene for welding and cutting will be supplied to local industry from this point. Mr. J. J. Robinson is in charge of the plant and Mr. S. P. Murphy, whose headquarters are at Cincinnati, is district superintendent.

At the meeting of the American Institute of Steel Construction which will be held at Biloxi, Mississippi, November 13th to 17th, Mr. J. R. Dawson, Union Carbide and Carbon Research Laboratories, Inc., will read a paper on the use of the oxy-acetylene flame for cutting structural steel.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of THE WELDING ENGINEER, published monthly at Chicago, Illinois, for October 1st, 1928.
State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared H. S. Card, who, having been duly sworn according to law, deposes and says that he is the business manager of THE WELDING ENGINEER and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher—G. H. Mackenzie, Chicago, Illinois.
Editor—H. S. Card, Chicago, Illinois.
Managing Editor—H. S. Card, Chicago, Illinois.
Business Manager—H. S. Card, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
The Welding Engineer Publishing Co., 608 S. Dearborn, Chicago, Ill. G. H. Mackenzie, 7115 Luella Avenue, Chicago, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is. (This information is required from daily publications only.)

H. S. CARD,
Business Manager.

Sworn to and subscribed before me this 28th day of September, 1928.

(Seal) William Derzbach.
(My commission expires April 7th, 1929.)

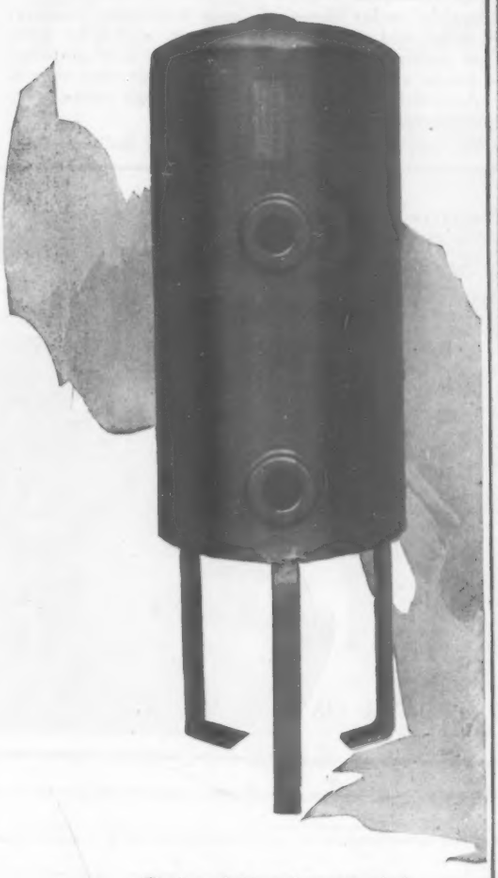
Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address.

Alternarc Welder Sale—Delivery at once. Three machines, 220 to 440 volts, 60 cycles, minimum 40 amps., maximum 400 amps. Also 45-90 amps. Two machines 200-220 volts, 60 cycles, minimum 30 amps., maximum, 300 amps. Priced so that it will pay you. Rent, terms, or cash. Write, wire or phone Pavlik Bros., 554 Railway Ave., Phone 280, Kenilworth, Ill.

For Sale—Alternarc welding and cutting machine. Address Box 164, care of The Welding Engineer.

For Sale—16 H. P. 2 cylinder Reliable gasoline engine, mounted on steel base and suitable for belting to welder or other machine. Price, $150. Goodman Electric Machinery Co., 126 Green St., Newark, N. J.



The legs of this tank were attached quickly and at a nominal cost by means of Tobin Bronze Welding.

TOBIN BRONZE*

makes possible an otherwise impracticable welding job

Welding legs to this tank by the use of steel rods presented a difficult problem as the intense heat required would have opened the arc-welded seams.

Tobin Bronze welding by the oxy-acetylene process offered no such problem. The weld was quickly made without damage to the tank because Tobin Bronze flows freely at 1650°F. and consequently does not require extensive preheating. Considerable time can be saved by using Tobin Bronze as welds can be made with this material in one-half to one-third the time required with iron or steel rods.

An Exclusive Anaconda Product

Tobin Bronze is an exclusive product of The American Brass Company. It is the most satisfactory material for general oxy-acetylene welding of cast-iron because of its low melting point, high tensile strength, ductility and uniform composition. Tobin Bronze rods are stocked by distributors of welding equipment and supplies everywhere. Look for the name "Tobin Bronze" stamped in every rod.

* Trade-Mark Reg. U. S. Pat. Off.

There is a suitable Anaconda Filler Rod for every welding purpose. The principal Anaconda Welding Rods, with their melting points, are listed below.

for oxy-acetylene welding

Tobin Bronze	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Deoxidized Copper	1981°F
Electrolytic Copper	1981°F
A. B. Naval	1625°F
Everdur	1866°F
Ambrac	2102°F

for arc welding

Phosphor Bronze	1922°F
Everdur	1866°F
Ambrac	2102°F
Deoxidized Copper	1981°F

THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LIMITED
New Toronto, Ontario

ANACONDA
WELDING RODS

ANACONDA
from mine to consumer

"STANDARD"
Welding Wire
GAS AND ELECTRIC
A grade for each type of work—send for samples.

for sound permanent welds : : lower costs
Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.
Prices on request.
Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

REBUILT WELDERS
We Buy, Sell, Exchange and Rent
ARC WELDERS
SPOT WELDERS
We are also Factory Representatives for New Machines
GOODMAN ELECTRIC MACHINERY CO.
126 Green St., Newark, N. J.

Annual Clearance Sale
(Ending December, 1928)
OXY-ACETYLENE EQUIPMENT
Demonstration and Exhibition Samples

Milburn Welding and Cutting Outfits
Milburn Welding and Cutting Torches
Milburn Welding and Cutting Regulators.
Milburn Welding Generators.
Also Paint Spray Equipment.

At low prices for quick clearance—subject to prior sale. All apparatus guaranteed. Advise what you are interested in.

THE ALEXANDER MILBURN CO.
1416-1428 W. Baltimore St.
BALTIMORE, MD.

One Dollar will increase your earning power by bringing you any one of the following GUARANTEED FLUX FORMULAS—Cast Iron—Brazing—Copper—Nickel—High Speed Steel—Aluminum (sheet and cast). With instructions you can make up your own fluxes fresh. R. N. Robbins, 38 Winans Street , East Orange, N. J.

Lewis Seam-Welding Head
PATENTS PENDING
Fits Any Spot-Welder
Proven by 3 Yrs. Use

Will weld *side seams* or *bottoms* of buckets, pails or tanks at 15 to 25 ft. per minute and make joint water and gas tight.
Change from "Spot-Welder" to "Seam-Welder", or the reverse, made in 5 minutes.
One user has made over 1½ million 3 inch lap joints and then nickel plated the piece. **You can't find the joint.** No change to your spot welder — simply clamp head to upper horn. Bolt on the proper electrode for either transverse or longitudinal welding. The "drive" is a separate unit and NOT attached to spot welder.
Send at once for Bulletin 129.
WELDING APPLIANCE CO.
2111 West Lake St., CHICAGO

Used
Arc Welders
Ten slightly used arc welders of various makes for immediate delivery. All in excellent condition.
Address Box No. 162
Care of The Welding Engineer

Wanted—New or used oxygen cylinders. The Carter Torch & Supply Co., 66 York St., Hamilton, Ont.

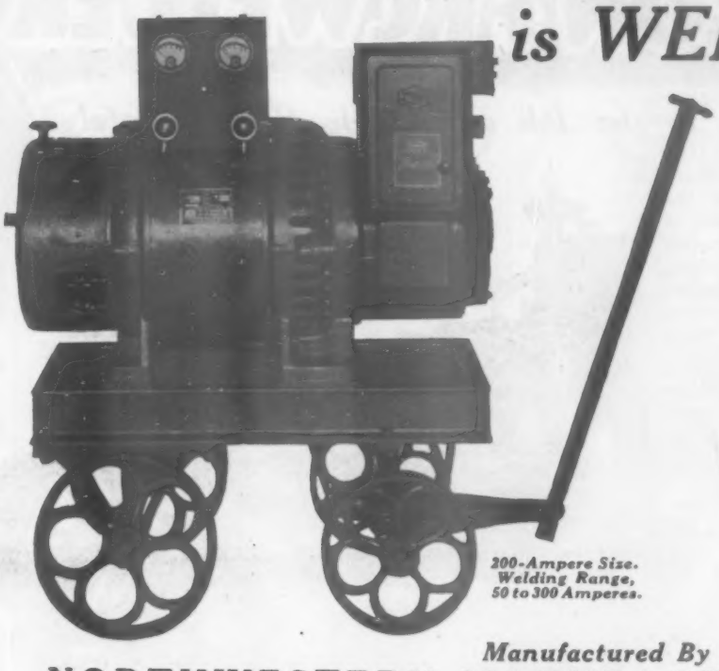
Position Wanted—By acetylene welder, thoroughly experienced on railroad work. Can give good references. Address Box 163, care of The Welding Engineer.

Position Wanted—Acetylene welder with 4 years' experience wants job welding in shop or on railroad. First class references. Address Box 219, Deer Park, Wash.

AMERICAN STEEL ENGINEERING COMPANY
3520 Queen Lane, Philadelphia
601 Granite Bldg., Pittsburgh

GE Arc Welders, GE Electrodes: TYPES A, B and F
Four Reconditioned General Electric Arc Welders. Price, $300.00 and Up.
Page-Armco Welding Wire and Electrodes
Write to nearest office for descriptive circular and prices

The First and Last Consideration is WELD QUALITY



200-Ampere Size. Welding Range, 50 to 300 Amperes.

The kind of welds produced by your operators depends to a very great degree upon whether you give them an arc *hard* to work with or one *easy* to work with. There is a radical difference in the characteristics of arcs produced by different welding generators, and that difference shows up in the quality of the welds. Give an operator an arc that is easily held to the proper length without continual, fatiguing manipulation, and he can't help turning out a better job. The HANSEN is designed to give the most easily controlled welding arc that can be produced. That fact explains the HANSEN'S rapidly growing popularity among operators and production engineers alike.

Manufactured By

NORTHWESTERN MANUFACTURING COMPANY

Clinton and Madison Streets Milwaukee, Wisconsin

---*for* Strong welds

Nichrome

TRADE MARK REG. U. S. PAT. OFF

---*the exceptionally strong* Welding Rod

Welds made with "Nichrome" the nickel-chromium alloy, possess exceptional strength. For example, practical tests of welds on mild steel made with "Nichrome" rods, show an ultimate tensile strength as high as 55,000 pounds per square inch. It is interesting to note that the welding operation does not detract from the metal itself.

"Nichrome" welds are readily machinable and may be applied by either the oxy-acetylene or arc welding process. The ease of application and free flowing qualities of "Nichrome" welding rod, together with the fact that it can find wide application, makes its use extremely desirable.

Sample? If you are having difficulty in getting a strong weld, we are sure "Nichrome" will prove satisfactory. *Sample rods will be sent on request.*

DRIVER-HARRIS COMPANY

HARRISON, NEW JERSEY

Chicago - Detroit - Morristown, N.J. - England - France

Alloy Makers since 1899

FUZON ARC WELDER

Travels to the Job and Back Again—Safely!

GAS ENGINE DRIVEN

No Exciter—No External Stabilizer

A bulletin describing the novel features incorporated in this machine will gladly be sent to you upon request.

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FUZON *Arc Welders* Weldite *Welding Rods*
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American Steel & Wire Company's

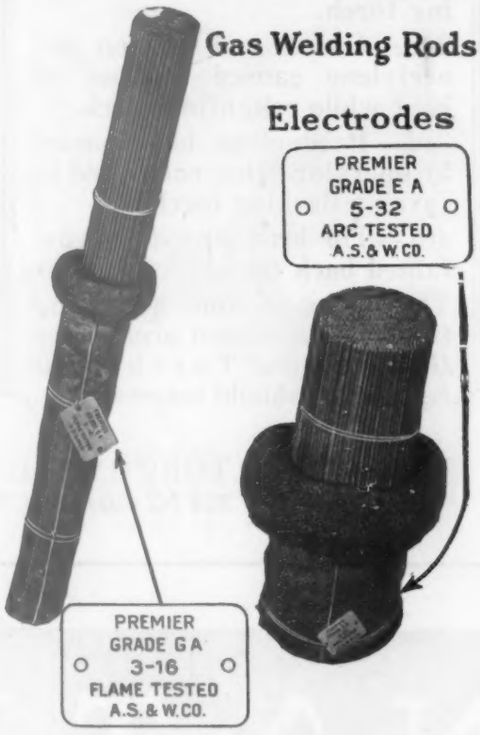
PREMIER

TESTED

WELDING WIRES

Gas Welding Rods

Electrodes



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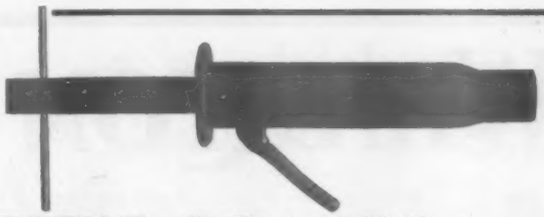

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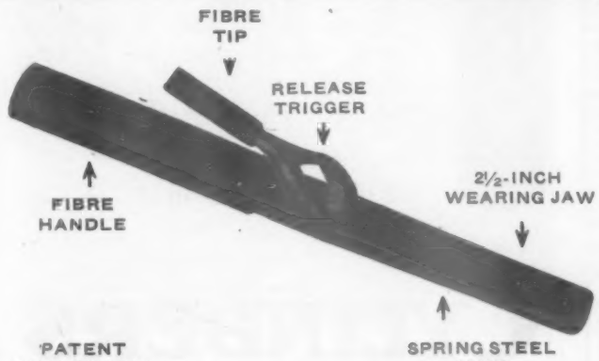

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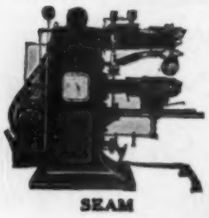

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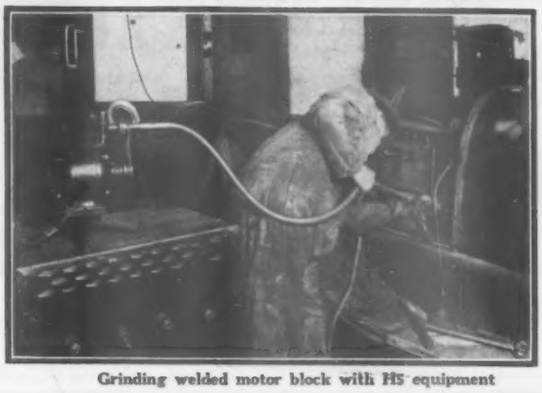

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PORTABLE ARC WELDER

Note: One seat in driver's compartment folds forward to give free access to generator.

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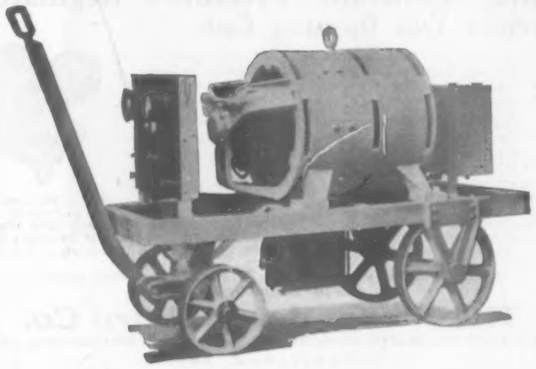

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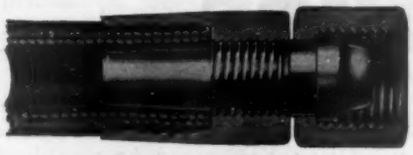

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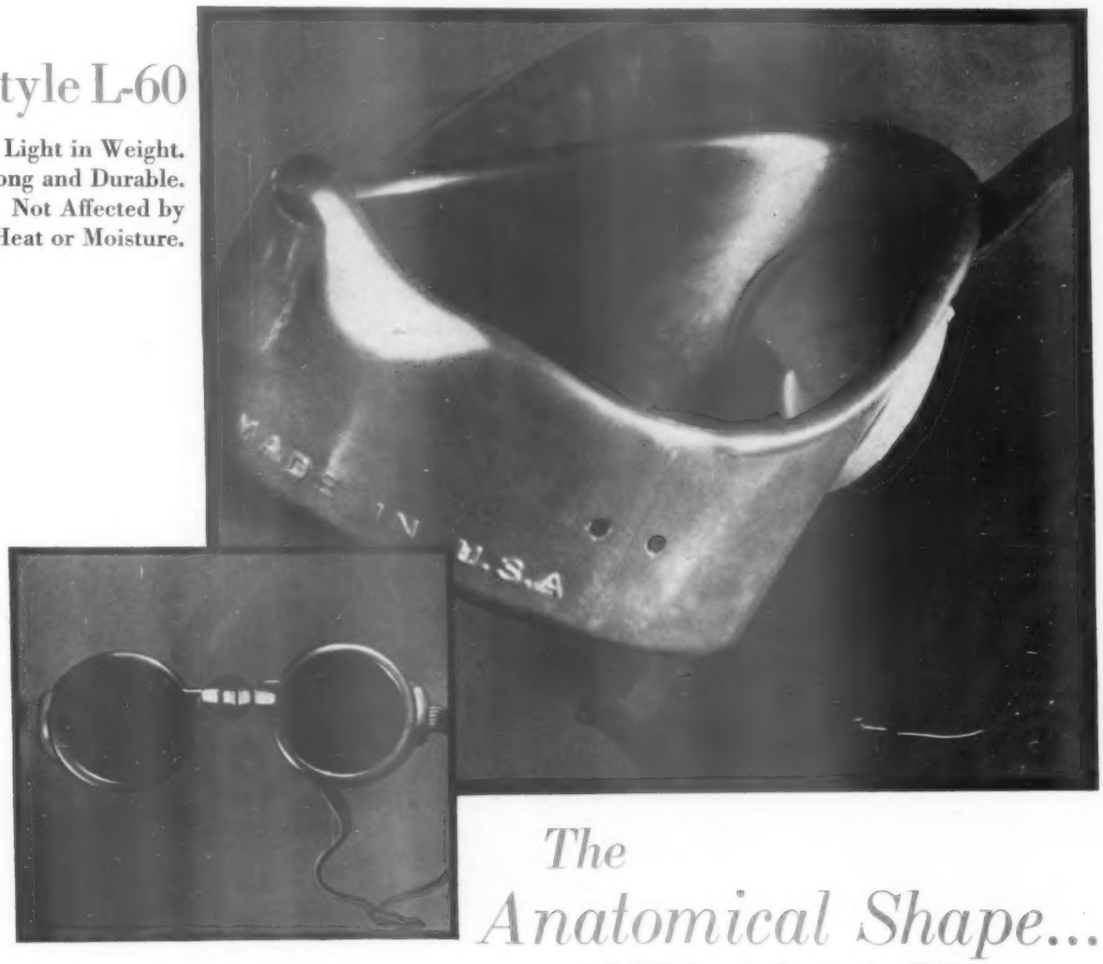

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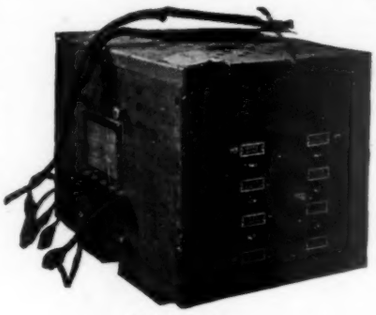

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